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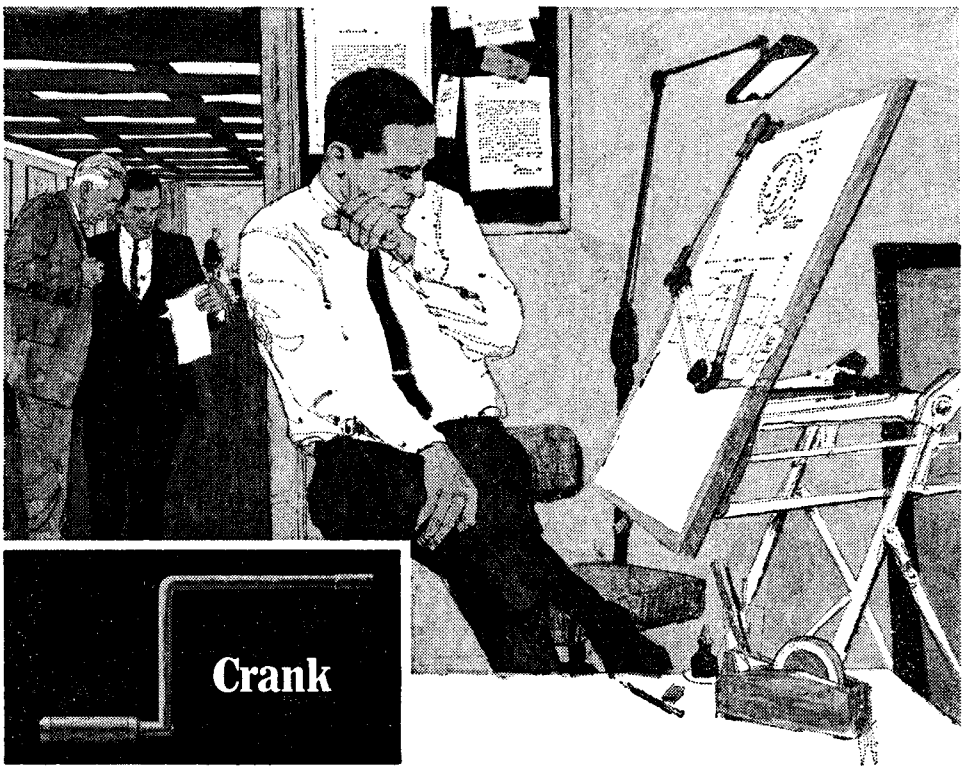

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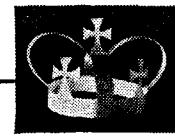
COLUMBIA  COLUMBIA

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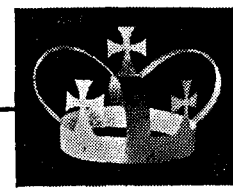

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Volume 35 *Spring, 1966* Number 2

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If You Don't Mind My Saying So . . . . .

JOSEPH WOOD KRUTCH

We are all aware (and we are all very frequently told) that technology has created a world that even our own parents would not have believed possible and that many of them would have contemplated with alarm. Most of this new world we take so completely for granted that we merely turn switches, dial telephones and board jet planes without asking questions and certainly without any vivid sense of their novelty or of the fact that we really know almost nothing about how they work or how they came to be.

The vast majority of us had nothing whatever to do with their creation and certainly were never given any chance to say whether or not we wanted them. We have been carried along on a tide and, although for the most part we have been willing to believe that "progress" really does represent a progression toward something desirable, it can hardly be said that we *willed* any of the things that have happened to us. In a very real sense, the telephone, the radio, the television, the automobile and the airplane were thrust upon us. And as the newest developments come to involve more and more esoteric principles and problems, the proportion of our citizens who can comprehend, much less work creatively with them, must become smaller and smaller.

One need only read the popular magazines and those advertisements that reflect even more accurately the attitudes of the popular audience to perceive that most of the members of this audience have, so far, felt no doubt concerning the desirability of our new world and have not ceased to believe that even faster transportation, more completely automatic conveniences, and still stranger machines will create a still happier world of tomorrow, of the day after tomorrow, and of that future that lies ahead "as far as thought can reach."

On the other hand, it is surely a fact of possibly enormous significance that a minority began a few decades ago to doubt the common assumption that "progress" means progressively greater happiness and to suspect that there is a danger in machines which we seem to control but which show an increasing tendency to control us. On a somewhat lower level, it is obvious to anyone who, like me, has read even a very few science-fiction stories that the Wellsian dream has turned into a nightmare.

Not long ago the statement was made, complacently rather than anxiously, that if all of the telephones now functioning in the United States were operated as they were only a few years ago, then, the entire female population of working age would be insufficient to manage the switchboards. Just how accurate that statement may be I have no way of knowing. But, accurate or not, it suggests the undeniable fact that we are more and more dependent upon mechanical devices and that this makes our whole civilization very vulnerable. Hundreds of different and complicated machines must continue to function or a paralysis followed by death would soon ensue. What happened last November when one small piece of electrical equipment failed will be long remembered—but not, I

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am afraid, long enough. In fact, on second thought I am not sure that it would do much good to remember it.

One of H. G. Wells's early stories had to do with a giant brain encased in a glass box from which it controlled world society. Break that glass and chaos would ensue. This is very nearly the situation in which we find ourselves. If there is a next world war—and it seems hard to believe that man will suddenly abandon an activity that he has persisted in since long before history began—it may well be by far the most destructive ever known, not only because of our vastly increased power to kill, but, also, because even a few small bombs could break so many links in the intricate chain of technology, every part of which is dependent upon every other part, that the loss of a few links would make the whole useless. We would be reduced to a simplicity we have forgot how to live with.

Years ago when I happened to be reading a volume of late Roman history I realized suddenly that the ancient world ended and the Dark Ages began when the army of Belisarius cut the Roman aqueducts and, overnight, turned Rome from a community with a water supply, said to have been comparable to that of a modern city, into a Dark Ages' town where a few wells and cisterns had to serve a large population. A calamity even greater, but no less easy to imagine, might introduce us to a new Dark Age.

Evolutionists always point out that any animal species that comes to be dependent upon a particular feature of its environment is in danger of extinction. The ivory-billed woodpecker disappeared because he could not survive without that abundant supply of decaying trees that had been eliminated from our well-managed forests. On the other hand, the undemanding English sparrow survived even the near-disappearance of the horse whose droppings he had so successfully exploited. He was adaptable enough to do without horses or, for that matter, without almost any other usual feature of his environment.

For a few hundred years it seemed as though the machines man had invented made him more secure, less at the mercy of nature's caprices. He was ceasing to be (as the English farmer complained in describing his occupation) "too dependent on the Almighty." But conveniences and facilities, which begin as no more than convenient and useful, turn rapidly into necessities as the population increases and as our life is more and more organized in ways that take them for granted. Cities got along without electricity for thousands of years. In many remote parts of the world, large areas are still so little dependent upon it that to cut it off would not create a major catastrophe or even a serious inconvenience. But suppose that bombs or sabotage were to deprive a major part of the United States of its technological life blood by making electricity unavailable, not only for a few hours, but for months. Goods could not be moved in; garbage could not be moved out. Before long we would be in a situation almost as impossible as that of the ivory-billed woodpecker deprived of his decaying trees.

Because I have already lived a little longer than the average man does, I have witnessed rather more than he of the recent accelerating take-over by indispensable machines. The automobile, radio, airplane and even the telephone were either invented or permitted to become indispensable to our society within my memory. I can imagine, as the majority of today's citizens cannot, what life was like without them. But the memory would do me no good if they were to disappear.

It is significant, moreover, that the newer technological devices depend upon principles more and more esoteric. The internal combustion engine, the telephone, the moving picture, the acoustic phonograph and even the airplane could be understood by the average child. In fact, three of these marvels were invented by tinkerers rather than by scientists. But if the laws governing the application of nineteenth-century physics were relatively simple, electronics, as distinguished from electricity, belongs to experts only. You and I know how a moving picture or a telephone works. But

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if we read an account of the way in which our television set works, it is hard to credit. And just in so far as our elaborate technology depends upon highly trained experts, just to that extent does the dependence make us more vulnerable. Once we needed little more than arithmetic to get along with our world. Then, unless we depended entirely upon others, a smattering of calculus was necessary to know what our betters were talking about. Now, within a very few years, anyone who cannot program a computer is as dependent upon those who can as primitive man ever was upon his witch doctor. What is perhaps even more alarming is the fact that even the experts depend upon other experts and, also, upon the existence of machines that they could not make for themselves if these machines happened to be destroyed.

In grammar school I learned (but of course long ago forgot) how to extract a cube root by the arithmetical method. Recently I have asked several professional mathematicians if they could perform that operation, and was told with a smile, "Of course not. You extract a cube root with a slide rule, a logarithm table or, nowadays, with the aid of a computer." But since most engineers could not calculate a logarithm table (a very lengthy job, by the way) or improvise a slide rule, much less construct a computer, even engineers would not know how to reconstruct the machinery of our civilization if it somehow collapsed or was destroyed.

A grim joke, current just after the end of World War II, consisted in the remark that, whereas the most important weapon of the next war would be the atom bomb, the most important weapon of the war after that would be the bow and arrow. That is as good a way as any of stating the fact that a calamity could so destroy all the mutually dependent features of our technology that generations, perhaps even centuries, would be required to build them up again by beginning at the bottom of the pyramid that rests upon a hundred primary tools and materials, none of which are available to man in the state of nature or, for that matter, were available to, say, Periclean Athens. What could an electrical engineer do on a desert island if he didn't have any copper wire?

Many people must be wishing that the secret of atomic fission had never been discovered. Some may even suspect that the invention of the airplane was a misfortune. Without it we would have much less reason to fear Russia or China, and would be spared the enormous expense and effort of defense—to say nothing of the possibility that such defense may prove inadequate. But we are saddled with the airplane and the atom bomb, and it looks as though we would have to live—or die—with them.

In a book written some years ago I compared the forces we have summoned up to the bottle imp in an oriental story. The all powerful imp will obey all commands except one. He will not get back into the bottle no matter how sternly he is commanded—and we cannot get rid of the powers we have acquired. Not long thereafter I met (I believe in the pages of the SCHOLAR itself) a perhaps more telling comparison that Thomas Mann suggested between modern man and Dr. Faustus. Having sold his soul to the Devil, Faustus has what appears to be a completely obedient servant. But the time comes suddenly when the servant will obey no longer. Instead of doing what Faustus bids, he carries his one-time master off to Hell.

Could anything short of the nearly total destruction of our civilization and, along with it, most of the inhabitants of all the "developed countries," rescue us from our own dangerous devices? Is there any possibility that we may voluntarily stop short of either complete dependence upon machines or, worse yet, a war in which both sides would suffer to an extent probably unparalleled since the days when conquerors, as a matter of course, put the conquered population to the sword.

Some sort of change of heart would certainly be necessary before we could begin to arrest, or even slow down, our increasing dependence upon increasingly complex machines. And although the man in the street

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still thinks of a brighter future only in terms of more, rather than less, technology, there are at least a few who are beginning to ask if we are not becoming more and more dependent and vulnerable rather than more and more independent and safe. That is, at least, faintly encouraging. But the problem of deactivating atomic weapons is even more difficult because a prerequisite seems to be an increasing consensus that appears less, rather than more, likely than it did only a few years ago.

Dr. Johnson (here, as my readers have learned to expect, he comes again) was once asked if *anyone* believed in the truths of religion in the same sense that one believes in the facts of everyday life. Johnson closed what was evidently an uncongenial topic to an uneasy Christian like himself by a firm and simple, "No, sir." Now, if most of those who say that mankind seems about to destroy itself really believed that statement "in the same sense" that they "believe the facts of ordinary life," we might manage somehow to escape the danger. But it is all but impossible for us to do so, and until the threat is seen to be more real than we can actually believe it to be, we will not take it seriously enough to help us find a way of avoiding it.

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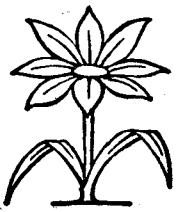

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Editorial

This special issue was conceived last July on the fair island of Chappaquiddick, just off Martha's Vineyard. Our week-end guests, John and Mary Ellen Johansen, were continually maneuvering to take possession of one book. I asked Mr. Johansen about it.

The book was Marshall McLuhan's *Understanding Media,* and Mr. Johansen, who is a distinguished architect, said that until he'd come across this book he had thought he was living in the present. "But now I know I'm way behind," he said. "There's a whole world out there that I've only begun to have a look at."

It was then that I decided there must be such an issue as the one that follows. Preparing it has been difficult, but not so difficult as it would have been had not a great convocation been held at Southern Illinois University last October. This conference, Vision 65, was the first of its kind. It was sponsored by the International Center for the Communication Arts and Sciences. The Center's President and Program Chairman of Vision 65, Will Burtin, declared, "This congress takes place at a time in history when fundamental social, intellectual and technological developments reshape the substance and meaning of reality. Every facet of our lives is affected and every value requestioned, as a steadily mounting pressure on the individual and on society is recognized."

A little later in his opening remarks, Mr. Burtin went on, "The first prospectus of Vision 65 stated that 'the time has come when we must question the continued usefulness of a principally opportunistic and essentially planless attitude toward content, employment and design forms in mass communications . . . The time has come for the professional practitioner to review implications of his work as well as the standards and values on which it is based.' " And finally, "Technology has made the world smaller and people interdependent. Conversely, the importance of communications has grown beyond any measure conceivable earlier. Their intellectual and esthetic improvement is now the major requirement for human survival and growth."

Through the cooperation of the Center, the contributors to Vision 65 and Southern Illinois University, THE AMERICAN SCHOLAR received permission to publish a number of these papers in the present issue. In some cases, we have deliberately left the original address form of the piece, in the interests of flavor. Among these is one by that astonishing man, R. Buckminster Fuller. I find it imperative to digress at this point, to pay tribute to him and to one

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of my colleagues, that longtime member of our Editorial Board, Harlow Shapley. Some twenty years ago (a little more, a little less), Dr. Shapley proposed at a meeting of the Editorial Board that we invite "Bucky" (as he called him) Fuller to write an article for us. "I suppose," he said, "that he's the brightest man alive."

There was a chorus of protest. "Crackpot" and "eccentric" are two of the terms used to express disapproval of inviting Mr. Fuller. Dr. Shapley's rejoinder was that these terms had also been applied to Jesus and Galileo and Einstein. But he did not prevail. Only now at last are we honored by having Mr. Fuller as a contributor.

Even now, much to our regret, through (ironic!) a failure in communication, we have only Mr. Fuller's concluding remarks at Vision 65. He also gave the keynote address, which is available to anyone writing to THE AMERICAN SCHOLAR and asking for it.

As plans for our first "electronic number" progressed, we continued to be fortunate. Phi Beta Kappa and Sigma Xi chose for their speaker at the joint December meeting of the American Association for the Advancement of Science J. Bronowski, whose topic was "The Logic of the Mind." Tradition has it that both THE AMERICAN SCHOLAR and *The American Scientist* publish this annual address. But this time it fitted beautifully into our planned Spring number and added a new distinction.

Other contributors were proposed by members of the Editorial Board, and we were again fortunate in the numbers of those who accepted. Lynn White, Jr., and Robert McClintock arrived in a state of innocence. Their papers, which appear in this number, were submitted, so far as I know, without any knowledge that there was going to be such an issue. Each was enthusiastically accepted.

Finally, at an AMERICAN SCHOLAR staff meeting, someone proposed securing an eminent American who had no direct connection, no specific training in the new techniques, but had played a role of importance in some field of mass communications, to read these pieces in advance and introduce the issue to its readers in a less limited way than this editorial can. We chose that veteran and pithy journalist and historian Gerald W. Johnson, formerly of the Baltimore *Sun*, one of the wisest men I have ever met.

I have the shivery feeling that by the time this number reaches your hands some of it may well be obsolete. But to revert to Mr. Johansen, I have at least the illusion that this is the nearest I have come to living in the present.

HIRAM HAYDN

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Some Cold Comfort

GERALD W. JOHNSON

ECONOMISTS, SOCIOLOGISTS AND POLITICIANS seem to be arriving, reluctantly, at agreement that the speed with which technology has been advancing in recent years has created a new class of the involuntarily leisured distinct from the transitionally unemployed whom automation forces from one job to another. Advancing technology raises the level of the minimal intelligence requisite to make an individual capable of self-support, and when the advance is very rapid it raises the level faster than some people can acquire new knowledge and skills.

Whether the disability is an effect of early deprivation or of increasing age, it is irremovable and the talk of retraining and adult education is largely gabble. There is really nothing to be done for these people except support them at the public charge until they ease the burden by dying off.

This is basically an economic problem that has received much, if thus far rather futile, attention. Less has been said publicly, but elderly Americans have done plenty of thinking privately, about the possibility that an analogous situation may be developing, not in the U.S.A., but in the Republic of Letters, and affecting the cultural climate rather than the Gross National Product. For the advance of technology is a reflection of the advance of basic science which has been, especially in the physical sciences, even more rapid and more significant than the advance of technology.

The extension of knowledge in these fields has been so great that a man whose college diploma dates back *consule* Coolidge is today mathematically illiterate unless he has continued his studies with exceptional assiduity. In a world proliferating ideas inexpressible except in mathematical symbols, many of them recently in-

GERALD W. JOHNSON, essayist, biographer and political commentator, is a frequent contributor to THE AMERICAN SCHOLAR. Mr. Johnson's most recent book is *Hod-Carrier*.

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vented, the ordinary, rank and file *Artium Baccalaureus,* or even a *Magister,* is heavily handicapped. His economic position may be sound enough, but he can hardly escape harboring some secret doubt of his survival as a contributing member of the community of intelligent people. This raises a prospect sufficiently appalling. It is to spend the rest of one's days as an intellectual pauper, subsisting on a meager dole of such ideas as were mental staples when Pershing returned from France.

To any whose spirit may lie in the shadow of this somber suspicion, the current issue of THE AMERICAN SCHOLAR is recommended without reservation. Of course it will not unveil the mysteries of the electronic age to a mind trained in the humanities, but it will acquaint a philologist, a jurisconsult, even a banker, with certain implications of the new science that bear directly on his own interests; and assuredly any lifting of one's intellectual horizon is to be desired.

So much is incontestable. Open to controversy, and therefore advanced tentatively, is my conviction that I found in these pages a reward more gratifying than glimpses of the far reaches of the physical universe. It is a cheerful suggestion that intellectual pauperism is not the inescapable destiny, in the electronic age, of a man whose education was in the humanities, and in whose mind the mathematical faculty has atrophied if, indeed, it was ever more than rudimentary. This pleasing impression, it should be acknowledged at once, is due to the honesty of the writers. Not one is oracular. None is as assured that he has anything like the last word as was Thomas Henry Huxley a hundred years ago. In these papers one detects a recurrent note of bafflement, a hint that those who man the farthest outposts of scientific thought suffer an affliction comparable to that of Mr. Dick, in *David Copperfield,* who could by no means prevent the intrusion of King Charles's head into his writing on a different subject.

King Charles's head in this instance would appear to be represented by synthesis. The "four ingredients of mathematics," according to Turnbull, are arithmetic, algebra, analysis and geometry. Synthesis has no place in the list because it appertains rather to philosophy than to science. It is an endeavor to answer the philosophic question, Why?, not the scientific questions, What? and

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How? Yet at the outermost bounds to which investigation of both the macrocosm and the microcosm has been carried, the philosophic question constantly intrudes, to the exasperation and also somewhat to the perturbation of scientists.

The violence with which Heisenberg has repudiated attempts to attach to his Principle of Indeterminacy an ethical significance, more especially an antinomian significance, is understandable and also revelatory. "That way madness lies" is his conviction, and from the purely scientific standpoint it is a logical conviction; yet a perverse and froward generation stubbornly proceeds that way.

Lynn White quotes the layman's remark to an astronomer, "Modern astronomy makes man look insignificant, doesn't it?" to which the astronomer replied, "But man is the astronomer." The scientific method was devised by man, and Karl Jaspers has asserted flatly that "the beginning of modern science is also the beginning of a calamity." Then if man has devised his own calamity, there is no species of logic powerful enough to persuade men to refrain from asking Why?, and to give the question priority over all other lines of inquiry.

The failure of philosophy to answer this question accounts for the eclipse of Plato and Aristotle by Bacon and Descartes. But if science, after five hundred years of ascendancy, now balks at the same barrier, its claim to superiority over every other form of mental activity is seriously undermined. It has outpaced philosophy in modern times, but it started further back. Now that it is apparent that its own lines of inquiry are converging upon the crucial problem of relating process and will—the ontological and the teleological, if you like to make "Quintillian stare and gasp"—it betrays the hesitation that deprived philosophy of its regal state.

For the further exact knowledge of the universe is extended, whether toward the movement of galaxies at one end of the scale, or toward that of electrons at the other, the more probable it seems that the point is not distant at which both order and measurement —logic and mathematics—must yield priority to relevance. The security and even the survival of man hang less and less upon his success in answering the What? and the How? and more and more upon his success in dealing with the Why?

The lore of the electronic age serves, in the last analysis, only

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to confirm the assumption, dating back into prehistory, that the heart and core of all mystery is not in the nucleus of the atom, or at the hypothetical pivot of the universe, but in the operation of the apparatus, obviously inefficient and often malfunctioning, that enabled Descartes to say, "I think." He said it and he clearly believed it. Whether his belief corresponded to reality is beside the point. It evidently does not with all men, nor with any men at all times. But the proposition that all men think they think does correspond to reality.

In the passage cited above, Jaspers asserts that, "Having the will to know is not a harmless business." One spectacular achievement of the electronic age is to show how appallingly dangerous it may be. Yet Jaspers' *sapere audi,* the courage to know, is inextinguishable in great minds and difficult to smother even in small ones.

To be sure Jaspers is a philosopher, and an existentialist at that, facts to be taken into account in weighing his testimony. McLuhan, arguing that the electric circuit takes us back to pre-Gutenberg modes of cognition, is, or was originally, a professor of English, a humanist, which doubtless tends to slant his view. Set them aside, if you will, as at most *amici curiae* in this investigation, yet the weight of the evidence presented by science itself supports the view that electronics—including, of course, everything appertaining to the electronic age—has as its central achievement a *reductio ad absurdum,* the discovery that the species of Homo called, doubtfully, sapiens, having through his desire to know learned so to control his environment as to assure his survival, has, by the identical means, perhaps assured his extinction.

Now every eminent expositor of the scientific method has held it axiomatic that if a carefully conducted scientific inquiry returns a fool answer, it is because the inquirer began by asking a fool question. Where, then, is the folly that produces the answer that man's highest wisdom is imbecility and that his apparent desire to survive is actually the death wish? It must be in the way in which the question was framed. It is not necessary to turn Benthamite to entertain the hypothesis that relevance is a component of knowledge. The knower and the known are not a pair, they are two-thirds of a trio. There remains the relation between them, a third factor as important as either of the others. In addressing Nature, to

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ask What? and How? without including Why? makes the inquiry defective and an absurd answer is the inevitable result.

Which permits the inference, comforting to the mathematically hamstrung, that investigation of antimatter, or some analogous inquiry, is not the only way in which a man can participate in the intellectual life of the electronic age. There is also the investigation of antiman, that mysterious but familiar entity seeming to be a mirror image of everything human, a perfect replica of a man but reversed—Modred, Ganelon, Iago, to confine the list discreetly to fictitious specimens.

This is, of course, the immemorial but as yet unsolved problem of evil, that science for five hundred years has deliberately excluded from its purview. It is generally admitted that philosophy became sterile by its too exclusive devotion to investigating God. It is the revelation of the electronic age that science, investigating Nature exclusively, may have been led into a similar cul-de-sac, long indeed, but whose dead end is now definitely in sight.

This is cold comfort, but not as icy as the possibility, now verging toward probability, that the indefinite elaboration of the scientific method may result in the extinction of the human race. It reveals the possibility that the force that devastated Hiroshima is really insignificant by comparison with the force that devastated the district of Watts, in Los Angeles. For the force that devastated Watts, if it could be brought under control, would almost certainly open up lines of approach to the solution of the urgent problem of defusing the bomb.

No computer will ever do it, for it is not amenable to mathematical analysis, and nobody knows this better than the men who have done most to extend the boundaries of scientific knowledge. This is the reason I think that reading the current issue of THE AMERICAN SCHOLAR may stimulate rather than obfuscate even the mind that, wandering among words and symbols with which the thickest dictionary has not yet caught up, is as confused as Theseus in the Minoan labyrinth. For Terence, certainly a very odd Ariadne, long ago gave us a clew, a thread by which we may possibly find our way out; and in this new world of strange and even nonlinguistic utterance, we may have something relevant to say as long as we remain firm in the faith that nothing human is alien to us.

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Address at Vision 65

HERBERT MARSHALL McLUHAN

I bring you greetings from the country of the DEW line, or early warning system. Canada carries perhaps a potential role as an early warning system. As the United States becomes a world environment, Canada might serve very well as an early warning system for culture and technology, and on many levels. But this is a whimsy.

We had a delightful story at lunch about the French actor who expressed the delight he had on the stage because of its permitting him to kiss ladies' hands. He said: "You know, you have to begin somewhere." The companion piece to that one is somewhat closer to my predicament—the mosquito in the nudist colony who said: "I don't know where to begin."

The world of humor, as a system of communications, is one that has occasionally interested people, and we live in a time when joke styles have changed very rapidly. I am told by my own children that the latest form of joke concerns the "Poles," and they gave me as an example: "Alexander Graham Kowalski—the first 'telephone Pole.' " This kind of humor is like the slightly older form of the elephant joke and the kind that the computer programmers enjoy—"What is purple and hums?" Of course, the answer is: "An electric grape." "And, why does it hum?" "It doesn't know the words." This kind of joke appeals enormously to youngsters today.

If you notice, the tendency in these kinds of jokes, or gags, is for the story line to be stripped off. They tend to be deprived of the old story line, and in its place you have a capsule, a compressed overlay, of stories. In fact, there are usually two stories in these little jokes, simultaneously. The older-fashioned jokes had a straight story line. Steve Allen has a theory that the funnyman is a man with a grievance. In French Canada there are a good many jokes going around these days that are by way of being grievance stories. One of them is this: A mouse being pursued around the house by the house cat, finally finds a little spot in the floor to creep in and hide. After a while, everything seems quiet, until suddenly there is a kind of "Arf-Arf-Bow-Wow" noise and the mouse feels the dog must have frightened the cat away, so it pops up and the cat grabs it and chews it down. As he chews the mouse down, he says: "You know, it pays to be bilingual." That is the old kind of square joke with a story line around it.

The new stories tend to be much more compressed and on two levels at once, like the sort of *Finnegans Wake* phrase: "though he might have been more humble, there's no police like Holmes." That kind of compressed double-plot story is a very interesting development; and, if you notice, great successes like *My Fair Lady* usually have two plots. One of them is explicit. One is perfectly obvious, like the story of Liza Doolittle acquiring the King's English and becoming a great social success. But there is a subplot in *My Fair Lady* that is much more potent and much concealed. The subplot would seem to be "how to succeed in business without really trying."

The subplot is an environmental one—it includes everybody. The main plot, the little story about Liza Doolittle, appeals to a relatively small group and is not a new story. It is a Cinderella story. But the story of "how to succeed in business without really trying," or, in other words, how to become a huge success by sheer gimmickry, would seem to be the life story, the inside life story, of a very large proportion of the top executives of our world. In other

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words, *My Fair Lady* has this environmental subplot that is implicit and unverbalized, and that includes the audience. With the subplot, the audience goes right into action. With the main plot, they simply sit outside looking on.

There is a subplot in the famous Hathaway shirt advertisement of the baron with the black patch on his eye. The main plot is simply Hathaway shirts. The subplot, the one that really includes the whole audience, is the black patch which bespeaks the world of aristocratic intrigue, hunts for hidden treasure, and many other mysterious dimensions, all expressed instantaneously by the black patch. The subplot world, the subenvironment, is really that which includes the audience, and it is the power to effect this kind of inclusion that is the mystery of humor, and that explains the rapid change of humor styles—because one style joke will not accommodate a very large proportion of the audience from one period to another.

There is a new book by Jacques Ellul, the Frenchman. The book has recently been published in English. It is called *Propaganda.* Ellul's book has as a theme that propaganda is not ideology; it is not the Hathaway shirt story. It is rather the hidden, but complete, image of a social way of life that is embedded in the social technologies and social patterns, as it is embedded in, say, the English language. Ellul would say the action of the English language, the action of the French language—*that* is propaganda. That presents a total environmental image to men, whereas the ideologies, the explicit verbalized messages, are relatively insignificant compared to this overall image. Ellul's theme in a word is this: Propaganda consists in using all the available means of one's society to create a way of life. Whatever that way may be, is propaganda—that is action that is total and invisible, and invincible.

This is another mysterious feature about the new and potent environment we now live in. The really total and saturating environments are invisible. The ones we notice are quite fragmentary and insignificant compared to the ones we don't see. The English language, for example, as it shapes our perceptions and all our habits of thought and feeling, is quite unperceived by the users of the English language. It becomes much more perceptible if we switch suddenly to French. But in the case of environments that are created by new technologies, while they are quite invisible in themselves, they do make visible the old environments. We can always see the Emperor's old clothes, but not his new ones.

I want to use this theme a little bit for our purposes here this afternoon. If the new environment is invisible, it does serve to make very visible the preceding environment. The obvious and simple illustration of that is the late show. On the late show on television we see old movies. They are very visible; they are very noticeable. Since television, the movie form has been reprocessed. The form of movie that once was environmental and invisible has been reprocessed into an art form, and, indeed, a highly valued art form. Indirectly, the new art films of our time have received an enormous amount of encouragement and impact from the television form. The television form has remained quite invisible—and will only become visible at the moment that television itself becomes the content of a new medium. The next medium, whatever it is—it may be the extension of consciousness—will include television as its content, not as its environment, and will transform television into an art form; but this process whereby every new technology creates an environment that translates the old or preceding technology into an art form, or into something exceedingly noticeable, affords so many fascinating examples I can only mention a few.

There is a wonderful book by Eric Havelock that I delight to refer to. Havelock, a year or so ago, published a book called *Preface to Plato.* It is a study of what happened in Greece before Plato. "Preface" means how did the Greeks educate each other before writing? What were the processes by which they educated their young people before Plato? He calls this process that preceded Plato "the tribal encyclopedia." The young memorized the poets. The poets were operative purveyors of

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practical wisdom and council. Homer, Hesiod and the rest actually provided the young people with models of perception and models of behavior and strategies for overcoming all sorts of difficulties and obstacles. The great Odysseus was above all a Greek hero because of his resourcefulness —his unfailing initiative and skill in every type of opaque and threatening situation. Havelock describes this education that went on by the poets, the tribal encyclopedia, and then describes the advent of writing and the complete change that came over education as a result of that. With the coming of writing, education shifted from the memorizing of the tribal encyclopedia that made education a sort of "singing commercial." With writing came the classification of knowledge, the ideas, the categories; and Plato's detestation of the poets was mainly a rivalry with the old educational establishment which had naturally failed to come to grips with the new technology of the written word.

Havelock's book has a fascinating quality, because it really tells the story of what we are going through right now. We are playing that tape (the situation he describes) backward—the change from tribal man to individual man. As we move into the world of integral, computerized knowledge, mere classification becomes secondary and inadequate to the speeds with which data can now be processed. As data can be processed very rapidly we move literally into the world of pattern recognition, out of the world of mere data classification. One way of putting this is to say that our children today live in a world in which the environment itself is made of electric information. The environment of the young person today is typically and principally electrically fashioned information. The young person today is a data processor on a very large scale. Some people have estimated that the young person, the infant and the small child, growing up in our world today works harder than any child ever did in any previous human environment—only the work he has to perform is that of data processing. The small child in twentieth-century America does more data processing—more work—than any child in any previous culture in the history of the world, according to Jacques Ellul, among others. We haven't really cottoned on to the fact that our children work furiously, processing data in an electrically structured information world; and when these children enter a classroom—elementary school—they encounter a situation that is very bewildering to them. The youngster today, stepping out of his nursery or TV environment, goes to school and enters a world where the information is scarce but is ordered and structured by fragmented, classified patterns, subjects, schedules. He is utterly bewildered because he comes out of this intricate and complex integral world of electric information and goes into this nineteenth-century world of classified information that still characterizes the educational establishment. The educational establishment is a nineteenth-century world of classified data much like any factory set up with its inventories and assembly lines. The young today are baffled because of this extraordinary gap between these two worlds.

Paul Goodman has a book recording one aspect of the situation. It is titled *Growing Up Absurd*. To grow up today is to be absurd, because we live in two worlds, and neither one of them inclines us to grow up. I have a friend who once pointed out to me something that struck me with great force. He said, "You know, the only work that royalty has to do is to grow up, and for a young prince or princess growing up and acquiring all the types of knowledge and language necessary for survival is a fantastically difficult job." It would seem that we have paradoxically created on a democratic scale a situation for royalty. Our youngsters today are mainly confronted with the problem of just growing up—that is our new work—and it is total. That is why it is not a job; it is a role. Growing up has become, in the age of electrically processed information, the major task of mankind. We still have our eyes fixed on the rearview mirror looking firmly and squarely at the job that is receding into the nineteenth-century past. The job that we feel we should have by rights belongs to the old mechanical technology of classified data

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and of fragmented tasks. Yet we are now surrounded by a new environment, of integrated tasks, integrated knowledge, and it demands pattern recognition. The kind of contrast between those two situations creates an absurdity that has launched the theater of the absurd. The theater of the absurd itself is postulated on this kind of dichotomy between these two cultures that never seem to get any closer together.

I have started then with the theme of the imperceptibility of new environments, and that what is perceptible in typical human situations is the old environment. It is plain that the content of Plato's work, of his new written form, was the old oral dialogue. The content of the print technology of the Renaissance was medieval writing. For two hundred years after printing there was hardly anything printed except medieval texts—think of poor Don Quixote! Don Quixote was the victim of the current Renaissance craze for medieval comic books or medieval romances. This went on for another century. What got printed in the main, for two centuries and more after the printing press, was the medieval tale, medieval Books of Hours, medieval liturgies and medieval philosophy. Shakespeare lived in the Renaissance world, and the content of Shakespeare's plays, as everybody knows, is medieval. His politics, and his world picture—the Elizabethan world picture—present a medieval world picture. They too looked back firmly and squarely at the receding medieval forms. But the Middle Ages were the late show for the Renaissance. By the nineteenth century the Renaissance had come into full view. As the industrial environment formed, this progressive time firmly and squarely confronted the Renaissance. The content of the nineteenth-century mind was the Renaissance; the content of the twentieth-century mind is the nineteenth century. We are obsessed with it. It is not as easy to banish that mirage as one might wish. But one of the most bizarre growths in this development occurred when railways and factories came in. The content of this new industrial, mechanical environment was the old agrarian world, and there was this upsurge of awareness and delight in the old agrarian environment of arts and crafts—the pastoral world. This discovery of the receding age was called the "romantic movement."

The sudden discovery of nature was made possible by the railway and the factories that were so very different from nature. The romantic movement was a product of the mechanical age by way of a contrapuntal environment. It was not a repeat of the mechanical age; rather it was the content of the mechanical age, and the artists and poets turned to processing the old agrarian world into delightful landscapes and delightful pastoral poems. This was in turn altered by the rise of electric technology that went around the old mechanical world of a few decades ago. When the electric technology jacketed the machine world, when circuitry took over from the wheel, and the circuit went around the old factory, the machine became an art form. Abstract art, for example, is very much a result of the electric age going around the mechanical one.

In our time we can see that pop art consists in taking the outer environment and putting it in the art gallery, or indoors somewhere, suggesting that we have reached the stage where we have begun to process the environment itself as an art form. We may be catching up with ourselves. When we begin to deal with our actually existing new environment as an art form, we may be reaching that stage the planet itself seems to have reached. With satellite and electronic antennae as probes, the planet ceases in a way to be the human environment and becomes a satellite itself—a probe into space, creating new space and environments for the planet. If the planet itself has thus become the content of a new space created by its satellites, and its electronic extensions, if the planet has become the content and not the environment, then we can confidently expect to see the next few decades devoted to turning the planet into an art form. We will caress and shape and pattern every facet, every contour of this planet as if it were a work of art, just as surely as we put a new environment around it. Even as the Romantics began to deal with the old pastoral, agrarian world as an

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art form when machinery was new, so we will now begin to deal with the planet itself as a work of art.

I think the computer is admirably suited to the artistic programming of such an environment, of taking over the task of programming the environment itself as a work of art, instead of programming the content as a work of art. This situation suggests some considerable changes in the human state. It suggests that the role of art in the past has been not so much the making of environments as making of counterenvironments, or antienvironments. Flaubert, a hundred years ago, said: "Style *is a way of seeing.*" *Ever since that time* the painters and artists have been quite conscious of their jobs as teaching people how to perceive the world they live in. "It is above all that you may see," said Conrad, apropos the meaning of his work. The training of perception upon the otherwise unheeded environment became the basis of experimentation in what is called modern art and poetry. The artist, instead of expressing himself in various patterns and packages of message, turned his senses and the work of art to the business of probing the environment. The symbolists, for example, broke up the old romantic landscape into fragments that they used as probes to explore the urban and metropolitan environments. Then they turned to probing the inner life of man with the same verbal instruments in hand. Instead of using the verbal as a way of expression, they turned it inward for the purpose of exploring and discovering the contours of the inner life.

The psychiatrist took over in the same pattern and began to erode the unconscious. If the unconscious has an important and irreplaceable function in human affairs, we had best look to it—it is being eroded at a furious pace; it is being invaded by dazzling investigations and insights; and we could quickly reach a stage in which we had no unconscious. This would be like dreaming awake. Such may well be the prophetic meaning of *Finnegans Wake* by James Joyce: his idea, among many others, that tribal man lived a dream and modern man is "back again Finnegan" into the cycle of the tribal involvement, but this time awake. This possibility that we are actively engaged in liquidating the unconscious for the first time in history, behooves us to pay some attention to how it is structured, and to what function it serves in human affairs. It may prove to be indispensable to sanity.

One overall consideration for our time and at a conference like this is to consider how, in the past, the environment was invisible in its operation upon us. Environments are not just containers, but are processes that change the content totally. New media are new environments. That is *why the media are the message. One* related consideration is that antienvironments, or counterenvironments created by the artist, are indispensable means of becoming aware of the environment in which we live and of the environments we create for ourselves technically. John Cage has a book called *Silence* in which, very early in the book, he explains that silence consists of all of the unintended noises of the environment. All the things that are going on all the time in any environment, but things that were never programmed or intended—that is silence. The unheeded world is silence. That is what James Joyce calls thunder in the *Wake*. In the *Wake* all the consequences of social change—all of the disturbances and metamorphoses resulting from technological change—create a vast environmental roar or thunder that is yet completely inaudible. It is like heat that in organic or other systems creates "noise." If the environment or process of change gets going at a clip consistent with electronic information movement, it becomes very easy to perceive social patterns for the first time in human history. In the pre-Electric Age patterns were imperceptible because change occurred just slowly enough to be invisible. Was it Bertrand Russell who asked, if we were in a bath whose temperature rose half a degree an hour, how would we know when to scream? The pattern recognition that is quite impossible during processes of slow change, becomes quite easy when the same changes are speeded up even to movie or cinematic levels. So, the artist, as a creator of anti-

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environments, or counterenvironments, created to permit perception of environments, has a very peculiar role in our society.

The artist as a maker of antienvironments becomes the enemy in society. He doesn't seem to be very well adjusted. He does not accept the environment with all its brainwashing functions with any passivity whatever; he just turns upon it and reflects his antienvironmental perceptions upon it. The artist, for the past century, has increasingly fused or merged with the criminal in popular estimation, as he has become antienvironmental. Since Baudelaire, the artist, the sleuth—the Sherlock Holmes type, the James Bond type, the Raymond Chandler-Marlow type—these men have turned a vision onto society that is very antienvironmental, very self-conscious, and the artist has mysteriously been hybridized with the criminal or the antisocial figure. By the same token, and I am just beginning to think about this while I stand here, crime has become obsessional in our society as a form of artistic expression. This is not lost on children. The delinquent child is often a very bright and keen, perceptive person. It is not lost on him that the kind of overwhelming, brainwashing forces of his environment really call for a little antisocial or artistic and exploratory activity. The child, by delinquent behavior, is aping the exploratory artist. Dostoevski was aware of this in *Crime and Punishment*. He saw the criminal as a sort of cross between the saint and the artist.

Our newspapers create an information environment, yet without crime as content we would not be able to perceive the environment. The newspapers have to have bad news, otherwise there would be only ads, or good news. Without bad news we could not discern the ground rules of the environment. This does not necessarily mean the environment is bad, but it means its operation upon us is total and ruthless. The environment is always the brainwasher, so that the well-adjusted person, by definition, has been brainwashed. He is adjusted. He's had it. There is a book by Erwin Straus recently that throws new light on Pavlov's operations (the Russian psychologist). He didn't get his conditioning effects by means of stimuli or signals to his experimental subjects. Rather he did it by environmental controls. He put them in environments in which there was no sound, in which the heat and other sensory controls were very carefully adjusted and maintained steadily. Pavlov discovered that if you tried to condition animals in an ordinary environment, it did not work. The environment is the real conditioner, not the stimulus or the content. So the Pavlov story needs to be turned around in order to be observed; but the role of crime as a way of perceiving society is a mysterious one. I am not going to make any moral observations on it whatever. It has increasingly pushed the artist and the scientist into the role of being an enemy.

Let me resume a moment. We have, in the Electric Age, come suddenly to the end of the Neolithic Age. After a good many thousands of years of specialized habits and technology and fragmentary toolmaking, we discovered the electric circuits. It is the circuit that has ended the Neolithic Age. The Neolithic Age, just like its ultimate phase, the factory age in the nineteenth century, was dedicated to specialism, fragmentation, and extensions of this or that limb of man. With circuitry we have, instead of extensions of hand, or foot, or back, or arm, a kind of involvement of the whole nervous system, an extension of the nervous system itself, a most profoundly involving operation. The form and function of the telegraph press can help our observations here. One of the mysterious things about newspapers is that the items in them have no connection except the dateline. The only connecting factor in any newspaper is the dateline, and it is this dateline that enables us to enter the world of the news, as it were, by going through the looking glass. Just as Alice in Wonderland went through the looking glass, when you enter the world of the telegraph or of the circuit, you really become involved in the information process. When you enter through the dateline, when you enter your newspaper, you begin to put together the news—you are producer. And this is a

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most important fact to understand about the electric time, for it is an age of decentralism. It is hard to face this. We still like to look in the rearview mirror. We still tend to think of the Electric Age as a mechanical age. It is in effect organic and totally decentralist. But the reader of the news, when he goes through his dateline appertures, enters the news world as a maker. There is no "meaning" in the news except what we make—there is no connection between any of the items except the instant dimension of electric circuitry. News items are like the parts of the symbolist structure. The reader is the co-creator, in a newspaper as in a detective story, in which the reader has to make the plot as he goes. The detective story was one of the very first anticipations of electric technology. Edgar Allen Poe was a considerable innovator in the matter of anti-environments for the Electric Age.

The newspaper is also very much like the world of the delightful films we have been seeing by Mr. Van Der Beek; the world of multiscreen projection is the world of the newspaper where umpteen news stories come at you without any connection, and without connected themes. So, what the new film is doing is stripping off the story line in favor of this mosaic pattern of simultaneous projection, which is very much in accordance with electric technology. It is the film world receiving its baptism by electricity. This hybridizing, this crossing of one technology with another, goes on all the time. The internal combustion engine was a wedding of the old machine and the electric circuit. Perhaps the most startling and most upsetting electric innovation is coming in the matter of xerox and xerography.

Xerography is bringing a reign of terror into the world of publishing because it means that every reader can become both author and publisher. It totally decentralizes the long centralized publishing process. Authorship and readership alike can become production-oriented under xerography. Anybody can take any book apart, insert parts of other books and other materials of his own interest, and make his own book in a relatively fast time. Any teacher can take any ten textbooks on any subject and custom-make a different one by simply xeroxing a chapter from this one and a chapter from that one. The problem is copyrighting, and Congress is now pondering these problems—how to protect the old technology from the new technology by legislation. It will not succeed. There is no possible protection from technology except by technology. When you create a new environment with one phase of a technology, you have to create an antienvironment with the next. But xerography is electricity invading the world of typography, and it means a total revolution in this old sphere, or this old technology, a revolution that is being felt in the classroom itself.

I invite you to consider that perhaps the best way of estimating the impact of any new environmental technology is to notice what happens to the older technologies. You can never perceive the impact of any new technology directly, but it can be done in the manner of Perseus looking in the mirror at Medusa. It has to be done indirectly. You have to perceive the consequences of the new environment on the old environment before you know what the new environment is. You cannot tell what it is until you have seen it do things to the old one. The need, however, to understand the processes and changes brought about by new technology gets stronger as the technology does. Therefore, in terms of design or style or shaping of perception, a conference of this sort is very timely in bringing attention to the tremendous new role of design in shaping human perception. "Style is a way of seeing," as Flaubert put it.

We are engaged in Toronto in carrying out a unique experiment—it is far too big for us—we need a lot of help and a lot of collaboration. We are carrying out an experiment to establish what are the sensory thresholds of the entire population of Toronto. That is, we are attempting to measure, quantitatively, the levels at which the entire population prefers to set its visual, auditory, tactual, visceral and other senses as a matter of daily use and preference—how much light, how much heat,

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how much sound, how much movement—as a threshold level. Anything that alters a sensory threshold alters the outlook and experience of a whole society. The sensory thresholds change without warning or indications to the users thereof, for it is new technological environments that shift these levels. We are concerned with what shifts occur in a sensory threshold when some new form comes in. What happens to our sensory lives with the advent of television, the motor car or radio? If we can establish this sort of knowledge quantitatively, we will have something that the computer can really bite into. A child is a genius till he is five because all his senses are in active interrelation. Then his senses shift. The computer will be in a position to carry out orchestrated programming for the sensory life of entire populations. It can be programmed in terms of their total needs, not just in terms of the messages they should be hearing, but in terms of the total experience as picked up and patterned by all the senses at once. For example, if you were to write an ideal sensory program for Indonesia or some area of the world that you wanted to leapfrog across a lot of old technology, this would be possible if you knew in the first place its present sensory thresholds and, second, if you had established what kind of sensory effect a given technology like radio or literacy had upon sensory life as a whole.

On this continent the sensory levels have changed drastically since television. The visual component in our lives has been dropped dramatically and the visceral, the kinetic, the auditory modes of response have shot up to compensate for the drop in the visual component of our culture. This sensory shift has changed the taste in design, in packaging, in every form of entertainment, as well as in every form of vehicle, food and in clothing.

The "Beatles" stare at us with eloquent messages of changed sensory modes for our whole population, and yet people merely think how whimsical, how bizarre, how grotesque. The Beatles are trying to tell us by the antienvironment they present just how we have changed and in what ways.

To repeat, and to make toward a conclusion, the effect of any new environment—every new technology creates a new environment just as the motor car does, as the railway did, or as radio and airplanes do—any new technology changes the whole human environment, and envelops and includes the old environments. It turns these old environments into "art forms"—old Model T's become precious art objects, as do old coach lamps, old anything. The world of Camp, for example, is the world of the nursery of thirty years ago being turned into a conscious art form. By simply taking into the shopwindow old toys, old ornaments, and the things Mom used to wear thirty years ago, you turn them into art forms and you have C-A-M-P, this mysterious new archetype.

The new environment is always creating new archetypes, new art forms, out of the old environment. This process can provide invaluable information for those who want to have some autonomy in controlling their destinies and their environments. I think we are rapidly moving toward a time when we might say, with full awareness of causes and effects: "In our present sensory condition, I don't think we could properly accommodate two hundred more lines on TV." Color TV will considerably change the whole sensory life of the public. It is a much more tactual form than black and white. But what would happen to the North American world if we did as the French and Germans have done; if instead of four hundred and fifty lines on our television, we were to put eight hundred? The results might be most gratifying to the educational establishment. If we raised the visual intensity or the visual component of the TV image, it might serve enormously to ease the transition from the old mechanical age to the electronic age.

What would be the chances of getting an experimental study of such a change in our time? I don't know. Lindegren would say the chances were not good. Anything that is serious is out of bounds. I think it was David Riesman who said no social scientist would ever study anything important. To be scientific you must study the fragmental, the insignificant. How else can you give assurance of your precision and

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concentration? Perhaps this attitude explains why, in our world, we tend to substitute moral indignation for observation. Moral vehemence is proof positive of superior perception. For example, we now experience simultaneously the dropout and the teach-in. The two forms are correlative. They belong together. The teach-in represents an attempt to shift education from instruction to discovery, from brainwashing students to brainwashing instructors. It is a big dramatic reversal. Vietnam, as the content of the teach-in, is a very small, misleading Red Herring. It really has nothing to do with the teach-in as such anymore than with the dropout. The dropout represents a rejection of nineteenth-century technology as manifested in our educational establishments. The teach-in represents a creative effort to switch the educational process to discovery, from package to prove. As with the Hawthorne experiment, its strategy is to use the audience and the student body as work force—one of the great things that is happening under electric conditions. As the audience becomes participant, involved in the total electric drama, it can become a major work force; and the classroom, as much as any other place, can become a scene in which the audience can perform an enormous amount of work.

The audience as work force has unlimited possibilities. Suppose we were to brief fifty million people on some extremely difficult problems facing top-level scientists. Inevitably, some dozens, hundreds, of the fifty million audience would see instantly through any type of opaque problem, even on the highest scientific levels. Robert Oppenheimer is fond of saying that "there are children playing in the street who could solve some of my top problems in physics, because they have modes of sensory perception that I lost long ago." There are enormous possibilities for using an audience as work force in scientific research, or any other type of research. It is simply that we insist on beaming instruction at them instead of allowing them to participate in the action of discovery.

For example, when printing was new, it created what was known as the Public. In the sixteenth century and after, Montaigne's phrase, *"la publique,"* came into use. The sixteenth century created the public as a new environment. This completely altered politics and altered all social arrangements in education, in work and in every other area. Electric circuitry did not create the public, it created the mass, meaning an environment of information that involved everybody in everybody. Now, to a man brought up in the environment of the public, the mass audience is a horror—it is a mess. In the same way, the public was a many-headed monster to a feudal aristocrat. He never bothered to study its structure any more than we study the mass. Circuitry brings people into relation with each other in total involvement which creates the possibility of dialogue and discovery on an enormous scale. The structure of the public had less of such possibility. The public consisted of fragmented separate individuals with separate points of view. The public was an additive structure. The mass audience is a quite different structure, enormously richer —enormously more capable of integrated creative activity than the old public was. All the old public could do was to enunciate private points of view which they clashed into each other furiously. At the present moment in Canada, if you want a DEW line warning, we are having an election in which no one is interested. There is no involvement because the old political forms do not permit participation. You simply register a fragmented, unrelated-to-anything vote. The population has dropped out of the political setup. Yet when these changing structures are studied they yield enormous meaning.

Let me suggest that it may be possible to write programs for changes, not only in consciousness but in unconsciousness in the future. One could write a kind of science fiction story of the future of consciousness, the future of the unconsciousness, "the future of an erosion." The future of consciousness is already assuming a very different pattern, a very different character. The future of the child is changing beneath our gaze. The small child was an invention of the seventeenth century, according to vari-

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ous historians like Philippe Aries; historically, the child came out of the seventeenth century, did not exist, so to speak, in Shakespeare's day. The child had, up until that time, been so completely merged in the adult world that there was nothing that could be called childhood in our sense at all. And so it is with the family, another seventeenth-century discovery. Suddenly today the child is merging with the total adult environment under electric information processing, and is disappearing from the scene as child.

The future of child may resemble the future of city. The city under conditions of very rapid movement takes on a totally new meaning. The motor car has served to destroy the city as it existed under the railway conditions. The future of city may be very much like a world's fair—a place to show off new technology—not a place of work or residence whatever.

It is also fascinating to consider the future of language. We know right now some very important structural things about language that are new. The future of language will not be as a system of classified data or meanings. The future of language as a complex structure which can be learned without learning the words at all, is a possibility that the computer presents increasingly. A child does not learn language as a series of meanings of words. He learns language as he learns to walk, or to hear, or to see. He learns language as a way of feeling and exploring his environment. Therefore, he is totally involved. He learns very fast because of this enormous sensuous involvement and the resulting motivation. It will be possible in this generation, I hope, to program the environment in such a way that we can learn a second language as we learned our mother tongue, rapidly and totally, as a means of perception and of discovery. The future of language presents the possibility of a world without words, a wordless, intuitive world, like a technological extension of the action of consciousness.

I had a friend visiting from Harvard the other day who said: "You see, my generation does not have goals." (He is a young architect.) "We are not goal-oriented. We just want to know what is going on." Now that means not a point of view but total ecological awareness. I was reading aloud from *Finnegans Wake* for a moment, and he said: "When you take L.S.D., the whole world takes on a multidimensional and multisensuous character of discovery, and when I listened to *Finnegans Wake* I got the same experience as L.S.D." (Perhaps *Finnegan* would be safer, and also more rewarding.)

The point this person was making was that it is absurd to ask us to pursue fragmentary goals in an electric world that is organized integrally and totally. The young today reject goals—they want roles—R-O-L-E-S—that is, involvement. They want total involvement. They don't want fragmented, specialized goals, or jobs. Now that is not easy to explain or to prescribe for.

I have touched upon the future of language, the future of consciousness, the future of the city, the future, perhaps, finally, of work. As a form of organized human activity, work is undergoing the most drastic changes of all; and there is nobody in the world who knows more about this than the great man sitting down here in front of me who has had a most paralyzing, I am afraid, effect upon my endeavors this afternoon, Professor Buckminster Fuller. I thought of a phrase I came across recently, "Home is where you hang your head." Now, to have in front of me in an audience a man like Buckminster Fuller makes me feel terribly at home in that sense. I really feel shatteringly humble. I am grateful to you for your most genial attention. Thank you.

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Vision 65 Summary Lecture

R. BUCKMINSTER FULLER

I have never been in a large conference at which I've felt as intuitively intense as I feel right now at this one. My intuitions tell me this has been an extraordinary meeting of human beings. I speak with the experience of many meetings—of human beings brought together because of their eminence in all manner of unique performance patterns. Their strength and variety gave hope that they would be able to contribute importantly to the answering of great questions.

The meetings of the last few years have been organized to address great questions, particularly on the forward implications of the impact of technology on world society. However, few, if any, answers of importance have developed.

At this Vision 65 Conference at Southern Illinois University, the whole set of circumstances seems to be extremely propitious for the formulation of some important realizations. Southern Illinois University was approximately unheard of until about nine years ago. It wasn't even a university until Adlai Stevenson as Governor of Illinois converted it from college to university status. It has, however, been in existence for almost a century, as a very small teachers' college, going back to within a few years of Abraham Lincoln's day in southern Illinois. Stevenson anticipated the flooding need for higher education facilities, so he created several universities, in the north, east, west and south of the state.

Southern Illinois had become a completely forgotten part of America. It dropped out of sight when the great north-and-south river traffic that plied on the Mississippi, Ohio, Missouri and Illinois rivers—all finally merged into one at the lower extremity of southern Illinois—was suddenly replaced a little over a century ago by the new era's east-west railroad, which crossed Illinois, from Chicago to St. Louis, well over a hundred miles north of Carbondale. So this very remote place in the heart of America was almost entirely forgotten except for its mine labor riots at Herrin, a half century ago.

Now southern Illinois comes into world prominence again as the place where it is the working assumption of a classless democracy that all of humanity should have the opportunity of an advanced university education. As S.I.U.'s President Delyte Morris has pointed out: it is the assumption here that "dropouts" indicate inadequacy of the educational system and not of the human individual.

I am certain that none of the world's problems—which we are all perforce thinking about today—which are also central to this conference—have any hope of solution except through society's being thoroughly and comprehensively educated, and thereby able to identify and communicate the vital problems of world society, and thereafter to sort and put those problems into order of importance in respect to the most fundamental principles governing man's survival and enjoyment of life on earth.

My intuitions are vigorous regarding the present alertness and almost apprehensive awareness of the particular human beings who have come here to this Vision 65 S.I.U. meeting from all around the earth. I have met many of the participants in other parts of the world; I know that the group who have come together here are unique. They are of the one-in-one-hundred-thousand type of thinker, who is realistically earnest in trying to find ways of making humanity successful. They have learned how to take the initiative. They

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don't need or want to be told what to do. My intuitions tell me, therefore, that this meeting is an unusually successful harvest of capably responsible human beings. I think it interesting that we have avoided negatives and that much that is useful and promising has been said about the functions and functioning of communication.

I often play a mental game, which I started a great many years ago. I patterned it after the physical discipline, with which all humans are familiar, of lifting progressively heavier weights on successive days, thus gradually to become more physically powerful. When I started playing my mental game, my scheme was to ask myself a little larger and more difficult question each day. I also gave myself a basic playing rule, that I must always answer the questions from my own direct experience. I have been playing that game for a long time. Finally I came to the question: What do you mean by the word "universe"? And I said to myself, if you can't answer that question, you must give up the use of the word universe, because you are being deceitful to yourself and others by suggesting that it has a meaning. Following my own rules, I gave myself the answer: Universe is the aggregate of all humans' consciously apprehended and communicated (to self or others) experiences. Because I had answered in terms of experience, my definition has withstood all subsequent testing by myself and others. I haven't been able to find any thinkable aspect of universe that has been overlooked. We have experiences of dreaming, falsification, multiplication of the numbers of words in the dictionary, and so on. I don't find any experiences that are not included in the definition. So, for the time being, I go along with that definition. It has been fruitful.

Playing the same kind of game and starting with universe as defined, I found that the universe definition included metaphysics because metaphysics deals with thoughts which are weightless. The physicist defining the physical universe (Einstein's famous definition) had deliberately excluded metaphysics because they are imponderable. So, I found it interesting that I had a definition that also included the metaphysical universe—of mathematics, thoughts and dreams as realistic experiences. And because all of my experiences had beginnings and endings, they were finite. I said, therefore, that the aggregate of finites must also be finite. Therefore, the universe, including both physics and mathematics, is finite.

In playing that kind of game I now had the advantage of being able to start not only with total finiteness but logically—as men, lacking a definition of the whole universe, had not been able to start logically before. This gave me many advantages, for the whole system was finite. I thus came logically to some mathematical discoveries regarding the thought processes. I would like to give you a simple way of looking at things, which I found appropriate once one starts with a definition of the finite whole.

I also found this process of working with finite logic from the whole to the particular to be a very effective kind of strategy in trying, for instance, to think our way through to understanding what our human function in the universe might be. I found that, when I was confronted with a vast question and an enormous amount of material and experience, one of the first things I always tried to do was to make a basic division of the universe and thereafter to subdivide the relevant parts into progressively smaller halves, always, successively, selecting the half most clearly containing—and therefore relevant to—the problem until I reached an understandable and very local level in universe. In developing the solution to complex problems in modern information theory, which governs the design of computers, this same principle of progressive subdivision and selection of the relevant half is used and each progressive subdivision is called a "bit" and the number of subdivisions totally required are known as "so many bits."

I found it is quite possible to subdivide the universe instantly by developing the concept of a "system." A system is a local phenomenon in the universe that is geometrically definable because it returns or closes upon itself in all directions. Systems may be symmetrical or asymmetrical. I

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found that systems are the first subdivision of universe for they subdivide the universe into all the universe that is inside and all the universe that is outside the system. This divided the universe into the macrocosm and the microcosm. Then came the extraordinarily surprising and sudden discovery that this system concept led to an important understanding of—what we do when we think.

I am quite certain that thoughts are not bright ideas mysteriously inserted into a vacuum chamber in the head. I'm quite confident that what we do when we think is to behave as follows:

We dismiss the irrelevancies. I find that our brain is filled with constant reports and notices in which we're being told about various events around us. All of us have experiences saying to one another, "What's that friend's name? You know, the man we both know. We were with him for three years." And neither of us can remember his name right away. But we all experience suddenly recalling the name possibly five minutes later, possibly the next morning.

The main point is that there is a definite lag in the search to memory storage and its feedback and that there is a great variety in the rates of lag between some recalls and others that we have stored deeply. Because we do get such feedbacks, we are always receiving a great deal of feedback from questions we had even forgotten that we had even asked. On my way here today I looked at a tree and I said, "What kind of a tree is that?" And I asked many other questions as I went along. I am asking myself questions all the time; and because the lags are very different for the different kinds of memories, I find that when I am lying down in my bed and trying to go to sleep, I get report after report coming back telling me about things that I had asked questions about and forgotten that I asked them. At all times we are in almost chaotic focus of brain-dispatched messengers trying to come into our conscious thought pattern to give us the answer to questions we or others in our presence have asked. Therefore, I have discovered that what I do when thinking is to say, keep those messengers outside for a moment. That's very interesting. I am glad they're there, but please keep them outside because all I want to think about right now is this glass of water.

I discover, then, that thinking is *a momentary dismissal of irrelevancies.* That decision immediately gives you one of those enormous opportunities further to divide the residual definition into two. This is possible because irrelevancies fall into two main classes: all the events that are irrelevant because they are too big to have any possible kind of bearing on the particular focus of our thought, and all the irrelevancies that are too small possibly to build up any significant relationships to alter the focal subject of our thinking. You find that what you have been trying to think about has a definite experience and frequency magnitude. Thus we find that all the irrelevancies that are too small are dismissed inwardly of the thought about local system and, therefore, dismissed into the microcosm because they can't catch up to the magnitude zone of the wave length and magnitude that we are working on; and the irrelevancies that are irrelevant because they are too big to have any effect on our considered focal system of consideration, are dismissed outside the system, that is into the macrocosm.

I find that there are also a number of temptingly almost relevants, which I might bring into our consideration, which might persuade you to be interested in what I am trying to communicate to you. Thus I learn that there is a Twilight Zone of Tantalizingly Almost Relevants. There are two such twilight zones—the macro and the micro—tantalizingly almost relevants. Between them there is always a set of extraordinarily lucid items of relevance. And when I pay attention to those lucid relevances I find that the minimum set that may form a system to divide universe into micro and macro cosms is a set of four items of consideration. I see next that between four stars that form the vertexes of the tetrahedron, which is the simplest system in universe, there are six edges that constitute all the possible relationships between those four stars. When we have found all the relationships between the

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number of items of our consideration we have what we speak of as "understanding." The word consider derives from the Latin words for *together* and *stars*. When we *understand,* we have all the fundamental connections between the *star* events of our consideration. When N stands for the number of stars or items of consideration, the number of connections necessary to understanding is always $\frac{N^2 - N}{2}$.

When I was invited to come up and meet with you now, I felt that I would like above all things not to allow myself to be affected by any conditioned reflexes that would make me say anything I had ever said before. I would like to think out loud as freshly as possible about the significance of this meeting. Our experience with Bob Osborn's cartoons gave us a good inventory of negatives. This doesn't bother me at all, because I am thoroughly aware of the experimental work done by nuclear physicists. One of their most important experimental findings shows that every physical component of the atom has its opposite, for example, the electron which is "negative" has its positron. Every positive has its negative and vice versa. The negatives of all those having positive weights have negative weights. This means that the average of all the weights of all the fundamental components of universe is zero. Although dealing with a universe of average zero weight, we find by experiment that we are (almost) always dealing with the positive or the negative which is our reality. We are dealing in a complex of pure principles that include a variety of time lags and thus create time and life as experience. This is an intellectual experience. Everything we cerebrate has to do with the principles such as lag, angle and frequency. I am never concerned when some people concentrate on enumerating negatives, because I know that each has its positive.

As noted, I must always go back to my own experiences for answers and my own experience inventory is short. It is only seventy years. But in that seventy years, I have experienced some extraordinary changes. The life insurance companies' mathematicians, dealing with all of mankind's vital statistics, are able to determine the probable "number of years that people born in a given year will live." This life-span is known by the insurance companies as the expectancy of individuals born in the given year. Expectancy for females usually is greater than for their contemporary males. My expectancy at birth was forty-two years. That was all that an 1895-born male was supposed to live. But conditions governing man's health and welfare improved rapidly, and expectancy began to advance at an historically unprecedented rate, so I have not yet caught up with expectancy.

The average distance that human beings could travel on their feet or in vehicles in their respective separate lifetimes up to and including my father's time was an average of thirty thousand miles. In my lifetime I have already swept out three million miles, which is one-hundred-fold the distance of all our forefathers. Now I am one of a class of several million men who have experienced three million miles around our earth. Our ecological pattern has clearly changed, and changed abruptly, from all the generations before us. Now the aviators and air hostesses make much more mileage than I do and each of the two Gemini astronauts knocked off my three million miles in one week of orbiting. Quite clearly man is moving into some very new relationship to his physical universe on a pure physical assessment basis. I recall my first pre-World War I jobs and working with men admirable for their strength and physical courage. I found I could win their friendship, but I was appalled at their mental inferiority complexes. Very few of them had gone to school for more than a few years, almost none had gone to high school, let alone finished. Very rarely did I meet anybody who had gone through college. My fellow workman was intellectually timid to a fault. He was a slave; he knew he had very little chance of happy and healthy survival. He was afraid of his words and his mind. He communicated his feelings by the way in which he chewed tobacco, spat and blasphemed, using a total vocabulary of no more than about fifty words.

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This was the everyday experience of all times for ninety-nine percent of humanity. Shakespeare and the historians write only about the doing of the one percent. The history of the ninety-nine percent is the same as the history of cats and dogs, who usually fared better than men. Yesterday this southern Illinois town of Carbondale was just a strip-mining coal town, where tobacco was chewed and spat, accompanied by the fifty-word vocabulary. These conditions have all changed in an extraordinarily short moment—in less than my lifetime. Here at Southern Illinois University are twenty-one thousand young people—probably very greatly affected by the radio and television in their childhood environments—to whom a good vocabulary is obviously and happily desirable. You have come to us from all around the world, speaking and organizing your thoughts with great integrity and without intellectual fear of your fellowman. But, in my memory humans, of the same origins as those of any S.I.U. student, who dared to speak a well-formed sentence were whistled at and treated as being some kind of sexual deviates. I know by personal experience that the world has changed and is changing at an ever faster rate.

When I was young going from a little town seven miles outside of Boston into Boston through Dorchester, or Roxbury, I saw that all the children in the streets were in rags. No exceptions. People on the trolley really stank. Women of twenty-six years were hags with half their yellow teeth out. There was no dentistry for them. It is my own direct experience that life has changed very much for the better.

Clearly, and sum totally, something very important is happening to man on this planet. Fred Hoyle, the great astronomer, dealing with the regularities found by astrophysicists in the heavens, has been able to say in all seriousness that he now assumes from the observed regularities that there are at least hundreds of millions of stars with planets that could maintain human life. He finds it logical to assume human life to be present in this universe on at least one hundred million planets. This particular big figure he uses is obviously intended to infer astronomical numbers of humans present in universe.

Dr. Hoyle—who is the Plumian Professor of Astronomy and Experimental Philosophy at Cambridge University in England—finds the case of humans on this particular planet to be precarious. He says humans have found atomic energy just in time to overlap the exhaustion of the fossil fuel supplies. Humanity will have to make other vitally important moves in a hurry.

I remember asking myself in my game of big questions whether there is anything in our experience that could tell us whether man might have an essential function to perform in the universe. Was he needed in the universe? Or was he—as he seemed to feel himself—just a chance observer, a theatergoer watching a great play called life. I said the only way we can judge whether he has a function or not is to go to our experimental data, and the way it came out is as follows.

With the development of steam, which could propel their ships when there was no wind, the great pirates, who mastered world commerce, saw that science could greatly advance their power, so they put up great amounts of money to back further scientific inquiry. The scientists developed the laws of thermodynamics and showed that energy continually and *always* escaped from local systems. Systems were always running down. This inherent energy dissipation was called entropy. The mathematicians described entropy as the *Law of Increase of the Random Element.* This concept is manifest by Sir Isaac Newton, when he said in his first Law of Motion, *A body persists in a state of rest—or in a line of motion* [clearly a secondary thought]—*except as affected by other bodies.*

"At rest" was the great norm. All the scientists went along with the second law in assuming that energy is leached out of the universe and that in due course the universe must run down and become motionless and dead. Life was abnormal and death was the normal state.

I entered Harvard University in 1913 just before World War I began. The Harvard community, and, in fact, Boston's large community of intellectuals, all assumed a

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universe that would ultimately run down, and that the earth had been spun off from the sun and would finally stop spinning. It is a very short time since people were thinking in that way. But in this century the scientists experimenting with entropy began to discover that when energy left one system it could only do so by joining another system. It did not go out of the universe. They found that energies were always one hundred percent accountable. This forced them into a completely new law, the Law of Conservation of Energy, which says: Energy cannot be created, and energy cannot be lost. Energy is finite. This eventually brought about Einstein's finite physical universe.

Einstein found himself confronted with this new way of looking at energy and also with the extraordinary experiments that disclosed the speed of light—experiments made not only in relation to visible light but to invisible radio signals, that showed that energy released *in vacuo* was moving at 186,000 miles a second.

Einstein felt forced to think about the universe in a different way from Newton. He said that inasmuch as no energy could be lost, then the universe could not "run down," and "at rest" was not normal. He then assumed a universe of continual transformation and its acceleration normal. He further assumed that normal velocity is the speed of radiation unfettered in a vacuum —186,000 miles a second. While that is very fast, he pointed out that it is not *instantaneous*. Einstein then pointed out that the universe is a complex of nonsimultaneous events, and because there is no inherent composite "picture" of nonsimultaneous and nonidentical events, there can be no possible unit and static conceptual picture of universe. "What is outside the outermost stars?" is a meaningless question. Thus Newton's simultaneous, all interlinked mechanical universe became invalid and obsolete.

The brightest star that we use in our navigation is Rigil Kentaurus. And Rigil Kentaurus is four and one-half million light years away and is of a brightness magnitude characteristic of the stars that burn out in a million years. Quite probably Rigil Kentaurus hasn't been "there" in the sky for three and one-half million years. We only have evidence about man being on earth for about two million years. In seeing Rigil Kentaurus, we are looking at a "live" show taking place two and one-half million years before man came on earth. In looking at stars in the heavens we are not looking at simultaneous events. There is no outside to what is not there. Our thinking gets an entirely new breakthrough with Einstein. In the philosophy of relativity Einstein postulates an all transforming universe, constantly transforming at various rates. He next hypothesized that although energy was traveling normally at 186,000 miles per second, it could be going around locally in knots and that it could be so local as to be confined to atomic patterning dimensions and that the tighter the heavier, and this resulted in his famous equation of $E = mc^2$ which fission a quarter century later proved valid as accounting for the amount of energy in any given mass.

There is now a very large inventory of ways in which man has been teaching, thinking and accounting events and values which have no experimentally demonstrated validity. There is no experimental proof of such phenomena as straight lines, solids and planes. There is no instantaneous phenomenon. The word is meaningless. The senses and brains of approximately all our scientists are disconnected from their theories. Scientists see the sun "going down" when they have known theoretically for five hundred years that it isn't "going down." Although our senses are not geared with our advanced knowledge, man has been getting along in a gradually more favorable way. His communication is no longer confined to the mode of his spitting.

Man is born utterly helpless and remains utterly helpless for a longer period than the newborn of any other living species. That's quite an invention—an extraordinary complex like man born utterly helpless. It is valid only under the assumption that he will be taken care of. Although the helpless child often has drunken parents, fortunately gravity holds him in his bed, and fortunately some cow ate some grass and made milk and somebody got it out of the

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cow and through a series of pourings by many people, it got into a bottle leading into the baby's gullet. It didn't come out of the mother's breast. In many ways, mankind is utterly helpless, vain and ignorant.

Human beings often say, "I wonder what it would be like to be on a spaceship." The answer is, "What does it feel like—you are and always have been on a very small spaceship, eight thousand miles in diameter." The nearest star Sun is ninety-two million miles away and the next brightest Rigil Kentaurus is not even there. You are very much alone in your spaceship. And this spaceship is designed so superbly, all its passengers so skillfully provided for, that they have been on board playing the game of self-reproduction for two million years without even realizing that they are on board a spaceship.

We see that all life has been able to succeed owing to the anticipatory design of a regenerative ecological energy exchange. The mammals give off the gases that are necessary to the survival of the vegetation, while vegetation gives off the gases that are essential to the survival of the mammals. None of them knows that he is contributing gratuitously to vital support of the other. I find that the earthworm is quite as irresponsibly, yet essentially, involved here, as is the bee. All of life is inadvertently and unconsciously involved. All of life has designed subconscious drives. Earthworms do the twist. But none of them realize the vital tasks they are doing for the others.

So I find all life interconnectedly successful and almost completely unwitting of the total ecological balance, which men sometimes speak of as "nature." The little bumblebee goes after his honey and his little fuzzy tail inadvertently knocks off and dusts pollen, which fertilizes vegetation. I think that is exactly the kind of pattern with which approximately all of humanity is preoccupied. I don't know any man who can stand up and say to us, "I am a success by virtue of having consciously designed, fabricated and operated myself, the biosphere, the sun, earth and all the intercomplementing ecology. I can tell you what I am doing with my lunch. I am sending off certain of this food to this gland and that gland, and I am going to use these differentiated energies in such and such ways."

We know humanity can't say that. Humans can't even tell you why they have hair. They certainly can't tell you that they are consciously pushing each hair out through their heads in special shapes and colors for special purposes.

We don't know anyone who knows much about what he is doing and why. Yet, one of the prominent, built-in behaviors of the occupational game-playing is the ego claimed credit for its inadvertent successes.

There are many indications, however, that man is just about to begin to participate consciously and somewhat more knowingly and responsibly in his own evolutionary transformation. I include evolution of the environment as a major part of the evolution of humanity. In his unconscious participation in the past he has carelessly ruptured his earth, polluted his air and water, corrupted his children in order to sell any kind of toy guns, dope, smut and anything that would make money, and has made all money-making sacrosanct. But if we discover that man is necessary to the invention of universe, we can understand somewhat better what he is inadvertently doing.

Some years ago, I asked myself whether man had a function in universe and if so, what it might be. My experience-informed answer went as follows:

The astronomers have given us their observation of the "red shift," which indicated that vast and remote star groups are probably receding from us in all directions because the light coming from them is redder than that from nearer groups, which in turn indicated an expanding universe. The expanding universe is also called for by the law of entropy or increase of the random elements which must ever fill more space. So I thought, we have also learned experimentally that unique behaviors are usually countered by somewhat opposite behaviors; therefore, an expanding universe would probably infer a concurrently contracting universe. So I said, "What experience do we have that may demonstrate such a contracting universe, even though none has

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been observed or mentioned by the astronomers?"

I saw that around our own planet we have high and low atmospheric "pressures," which might better be called expanding and contracting atmospheric patterns. I discovered clues to the operation of a contracting universe to be operative as our own planet. Our planet Earth is not radiant. It is not sending off energy in any important degree. As compared with a star it is "dead." Earth is receiving energy from the sun but is not losing it at the same rate. For instance, we have learned from the Geophysical Year that we are receiving about one hundred thousand tons of stardust daily. Our physical imports from the universe are as yet much greater than exports. Therefore, we are a collecting or concentrating center, possibly one amongst myriads in universe. All planets in universe may be collecting points as focuses of the contracting phase of universe. At the surface of the earth, in the top soil, the ecological balance becomes operative. The vegetation's chlorophyll inhibits the sun's radiation instead of allowing it to be reflectively rebroadcast to universe. The sun-inhibited energy impounded in the vegetation is further inhibited by insects, worms and mammals, and both botanicals and zoologicals are gradually pressured into the growing earth crust and finally are concentrated into coal and oil rather than being broadcast off to universe in all direction. By dissipating these energy concentrations, man may well be upsetting the expansion-contraction balance of universe.

The ecological balance is fascinating when viewed chemically. We find all biological systems continually sorting and rearranging atoms in methodical molecular structures. To ensure performance each species is genetically and environmentally programmed. Each sorts and reassociates atoms as its genes cope with and alter environment, which in turn alters the species behaviors.

Thus we see that all the stardust, cosmic rays and other radiation randomly dispersed into universe by all stars are being methodically converted by the biological activity around Earth's whole surface—in the sea and on the land—into progressively more orderly "organic" chemical structures. Thus biological life on Earth is antientropic. Earth is acting as an antientropic center as may all planets in universe.

Of all the antientropic sorters and rearrangers on Earth, none compares with brain-driven man. We find man continually differentiating and sorting out his experiences in his thoughts. As a consequence we find him continually rearranging his environment so that he may eat, be clean, move about and communicate in more orderly and swifter ways.

Dr. Wilder Penfield is the head of the Neurological Institute of McGill University in Montreal, Canada. He is one of the world's leading electrode probers of the brain. The brain probers have now identified, for instance, the location of various memory banks. Dr. Penfield says, "It is much easier to explain all the data we have regarding the brain if we assume an additional phenomenon 'mind' than it is to explain all the data if we assume only the existence of the brain." Why? Because they have found, so to speak, the telephone sets of the brain, they have found the wires connecting the telephone sets, they have found the automatic message-answering service and the storage systems; but, a great deal goes on in the conversations over the wires that is not explicable by the physical brain's feedback. I have submitted what I am saying to you to leading neurologists and they have not found fault with it. A good scientist doesn't applaud you publicly or right away, even though he is favorably impressed with your theory. But he does let you know whether he objects to what you are saying and what his objections are. And so far there have been no objections and there seems to be some affirmation of what I am about to say to you.

We have a phenomenon that we speak about as a generalization. In science, a generalization is very different from a literary generalization. Generalization in a literary sense means that you are trying to cover too much territory with some statement. The scientific meaning is precise; it means "the discovery and statement of a principle that holds true without excep-

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tions." I will give you an example. I am going to talk about a special piece of rope. I could have in my hands a foot length of three-quarter inch manila rope. But I can also say to you, "I am going to take an imaginary piece of rope," and I, not mentioning whether of nylon or manila, immediately generalize a rope concept from our mutual experiences. I am going to pull on that piece of rope and as I pull on it very hard it contracts in its girth. As it gets tauter, it gets tighter. This means that it goes into compression in its girth in planes at ninety degrees to the axis of the pull. I have found a great many human beings who think that tension is something independent of compression. I find experimentally, however, that tension can be only operative when compression is also present. A cigar-shaped vertical compression member that is loaded on its neutral axis tries to "squash." This means that its girth tries to get bigger. Which means also that its girth expands and is tensed. So I find that compression is never innocent of tension, but that they are cooperative in axes arranged at ninety degrees to one another. Sometimes I find tension, at what we call "high tide," or a highly visible aspect, and compression at "low tide" or at almost invisible aspect, and vice versa. We have here a generalization. We have found by experiment that "tension and compression only coexist." That is quite an advance over the first generalization just saying, "I take a piece of rope and pull it," which was a second degree generalization. And it is a third degree generalization when I say, "tension and compression only coexist."

A system subdivides universe into all of the universe that is outside the system and all of the universe inside the system. Every system, as viewed from inside, is concave and, as viewed from outside, convex. Concave and convex only coexist. Concave and convex are very different from one another. Convex diffuses energies by increasing wave lengths and widening angles. Concave concentrates energies by decreasing wave lengths and reducing angles. Although not the same and not exactly opposite, concave and convex only coexist.

In addition to tension and compression and convex and concave, I can give you a number of other such coexistences. This brings us then to another and further degree of generalization wherein we say that, "There is a plurality of coexistent behaviors in nature which are the complementary behaviors." That caused the mathematicians to generalize further. They developed the word "functions." "Functions" cannot exist by themselves. Functions only coexist with other functions. They are sometimes covariables. When I say, "Functions only coexist," I have gone a little further than the special cases of concave and convex or of tension and compression which were themselves highly generalized. Then I'll go further still and say, "Unity is plural and at minimum two." Which is the generalization that greatly advantaged quantum physics. We may go a little further in generalization, as did Einstein when he gave us his "Relativity." You can't have relativity without a plurality of cofunctions.

Now, I will give you another progression of events. You have seen a dog tugging at one end of a belt. He tenses it as he grips with it compressionally—with the concave and convex surfaces of his teeth. I am sure that you will agree that the little dog will never say, "*Tension* and *compression* only coexist," even though his brain coordinated them. The dog will not say, "*Concave* and *convex,* tension and compression are similar cases of coexistence of functions."

I think the neurologists go along with me in saying that, "What we mean by mind—in contradistinction to the brain of the animal or of man—is man's ability to generalize."

The ability to generalize—in its incipient phases—seems to me to be also a tendency to moralize. For instance, to say that, "If a man does so-and-so, he will get into trouble." I feel that in religious scriptures we come time and again to semigeneralizations showing how some men get into trouble and how you and your children may avoid such trouble.

We have seen how an enormous amount of special case experiences finally led to a progression of generalizations. There are

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about six degrees of progressive generalization. As we went from the one case to another and to higher degrees, it was accomplished with fewer and fewer words. We finally came to just one word, "Relativity."

Now this orderly simplification happens to be exactly the opposite of the mathematician's *law of increase of the random element.* It is the decrease of the random element. Generalization is the law of progressive orderliness.

I found myself in 1951 having to write in a book, which I was about to publish, that the mind of man seemed to be the most advanced phase of antientropy witnessable in universe. And if there is an expanding universe there is logically a contracting universe. Possibly man's mind and his generalizations, which weigh nothing, operate at the most exquisite stage of universe contraction. Metaphysics balances physics. The physical portion of universe expands entropically. The metaphysical contracts antientropically.

It is interesting that within a few months after my publication of the hypothesis someone told me that Norbert Wiener had just published the concept also that "Man is the ultimate antientropy." I talked with Norbert Wiener about this and we found that we had both written this at approximately the same time—starting quite differently but coming to the same conclusion.

So now we have found a function for man in universe, which was our objective. Man seems essential to the complementary functioning of universe. Therefore the probability of humanity annihilating itself and thus eliminating the antientropic function from universe is approximately zero.

This does not, however, mean that man on Earth may not eliminate himself. It suggests that there are—as the Cambridge University astronomer, Hoyle, suggests—hundreds of millions of other planets in universe with men living on them.

This brings us to the observation also that to keep her ecological balance intact, when nature finds the conditions are becoming unfavorable for any of the "cog wheel" species necessary for the system, she introduces many more starts of that species. She makes enormous numbers of babies, enormous numbers of seeds of this and that tree when she sees that such trees are not going to prosper. The seeds multiply in number, float off in the wind, randomly distributed in order to increase the probability of an adequate survival number to keep the system in balance.

I also go along with Hoyle in his concept of the possibility of the enormous numbers of human beings on an enormous number of planets simply because not all of them are going to make a success of life on their respective planets.

Man is beginning to transform from being utterly helpless and only subconsciously coordinate with important evolutionary events. We have gotten ourselves into a lot of trouble, but at the critical transformation stage we are getting to a point where we are beginning to make some measurements—beginning to know a little something. We are probably coming to the first period of direct consciously assumed responsibility of man in universe.

I spoke to you on my first day here about the great challenge of our day. I showed that it was no longer true, as had seemed true throughout all history, that man was born purposefully to be a failure in all but one case in a thousand—with the latter semisuccess occurring only as an "exception that proved the rule." Throughout ages it was probable that the average human would die before reaching the average human's twenty-seven years—despite scriptural accounts of great longevity. There just was not enough known sustenance for humanity. At the beginning of this century there was not enough for more than one in a hundred to survive comfortably and "live out his days," meaning "four score and ten"—ninety years. Expectancy for males when I was born was forty-two. Half potential age. Under those conditions, dying slowly is not pleasant, so why not fight. Why not have a good quick battle with everything to win and nothing to lose —better than rotting in the slum. As I said in my opening address, we will always have war until there is enough of every essential to support all lives everywhere around Earth.

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Every day, when it is available, each human consumes an average of two pounds of dry food, six pounds of water and inhibits the amazing figure of sixty pounds of air out of which he consumes six pounds of oxygen.

Food has often been very scarce, and often men have fought to the death for it. Water has sometimes been scarce and has been fought for. Air has rarely been scarce. Nobody has ever thought of putting a meter on the air for human consumption. But, we have had some terrible panics in theaters when there was a fire. Suddenly human beings—completely unused to competing for air—lose all reason, go mad and trample their fellowmen to death.

So I would simply say that there is nothing in our total experience that shows that when there is not enough to go around, it is illogical for men to fight to the death, because they are going to die anyway. There is also nothing illogical in the concept that when there is enough to go around men will not even think of fighting.

We now know scientifically that for the first time in history there can be enough to support continually all of expanding humanity at previously undreamed of and ever advancing standards of living and intellectual satisfaction in effective participation in the evolutionary processes. But we are frustrated from realizing our success by our different political systems and laws, which have all been devised to protect the few who have or have not adopted the system that promised the most in a bad bargain, or the most just system such as that which would provide for those whose labor produced the little that there was to go round.

I have made measurements in terms of work that can be done by human beings, measured by army engineers, in elevating foot-pounds per hours, days and years. From these studies I developed what I call an "energy slave" or the energy equivalent of the work a healthy human youth could do. The energy slaves in operation were determined by the amount of energies we were consuming from nature as waterpower, fossil fuels, wind, foods. Because up to now the distance that electrical energy could be delivered economically was only three hundred and fifty miles, industrial prosperity has been temporarily localized and has expanded only gradually. Therefore I took the total annual energy consumption of, for instance, the United States (of North America) for 1940 and reduced it by ninety-six percent because the machinery and processes used by man are of so overall low-grade design that he is only able to realize four percent of the consumed energy in potential effectiveness in the work accomplished. Despite this necessary reduction, I found that a very large number of energy slaves are working for humanity in our U.S.A. industrial economy. On the Eastern Seaboard of the United States in 1940 we had a hundred and thirty-five energy slaves working for each man, woman and child. And they were able to work continuously in extremes of heat and cold in which humans would swiftly perish. The inanimate slaves work with extraordinary precision at tolerances millionths finer than permitted by human sight.

I found, however, that an enormous proportion of all energy slaves' capabilities were going only into the development and production of weapons. Putting aside all the energy going into weaponry and retaining only that necessary to keep the people themselves going at a healthily high standard of living, I found that a family of five could be maintained at the high standard of living level with only one hundred energy slaves working for them in their economy—very few of the slaves work actually inside the house—they are employed in building the highways and keeping their telephone system in operation, *et cetera.* And this standard of living for a family of five produced by one hundred energy slaves was so high that it had not been known by any national sovereign before the twentieth century.

I found that in 1900 less than one percent of humanity were industrial "haves," but that changed very abruptly in and after World War I.

World War I witnessed intense mechanization of the world. In the year 1917, man took out of the ground, refined and put to work more copper than he had taken out of the ground in the whole cu-

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mulative history of man's copper mining and refining. He did so because copper is essential to energy distribution. He developed such intense mechanization in World War I that the percentage of the total world population that were industrial "haves" rose by 1919 to the figure of six percent. That was a very abrupt change in history suddenly to have six percent of humanity surviving at a high standard of living. By the time of World War II twenty percent of all humanity had become industrial "haves" despite that the population was ever increasing. At the present moment the proportion of "haves" is at forty percent of humanity.

Consisting mostly of recirculating scrapped metals, eighty percent of all the metals that have ever been mined are still at work. And all those metals are now occupied in structures and machinery which operating at full capacity can take care of only forty-four percent of humanity; that is, they can take care of four percent more than are now being taken care of. During this twentieth century the combined amounts of scrap and newly mined metals per each world man has been continually decreasing because population is increasing faster than discovery of new ore bodies.

For man to go from less than one percent to forty percent, living at high standard—despite decreasing resources—cannot be explained by anything other than by doing more with less.

We find doing more with less has come about entirely through the unique technology of the less than one percent of humanity that cast its lot with life on the ocean to master the great commerce routes of the earth. They developed a technology that could float in contradistinction to the dry-land custom of protecting oneself with great stone walls—of which the greater the thickness and height, the greater the popularly-assumed security.

On the sea one couldn't use stone—one would sink. On the sea men took fragile materials such as wood that would float naturally and, by scientific designs, produced extraordinary and powerful ships with which they battled the seas and one another, seeking to control the great sealanes of world commerce, seeking to be the greatest power. They developed more and more speed, hitting power and cargo space with ever less of invested resources in time, material and energy per each and every function of the ship and its equipment and that brought them to steam and the steamship, brought them to steelmaking, to make the great ship. Half a century later they began to have enough steel left over from shipmaking to put some into buildings on the land. From the battleship to the land came electric dynamos, refrigeration, radio, desalination, *et al.*

To control the world even more effectively with the airplane forced an international race to do even more with less. In doing more with less we have recently gone, for instance, from the latest seventy-five thousand ton trans-Atlantic cable of copper wires to telstar, which provides more communication more effectively with less than a ton of materials. We have not been thinking correctly of this technological-do-more-with-less revolution as being only a by-product of our scientific preoccupation with weapons. But it is now obvious on study that this is what has changed man's condition on earth. It takes, on average, twenty-two years for the "dynamo to come off the battleship" into our domestic use. If we have to wait for twenty-two years to bring the curve of "haves" to one hundred percent, this may be fatally slow.

If humanity understood that the real world problem is that of upping the performances per pound of the world's metals and other resources, we might attempt to solve that problem deliberately, directly and efficiently. It might be a world around university students' elective research undertaking.

But I find that approximately no one realizes what is going on. That is why we have been leaving it to the politician to make the world work. There is nothing political that the politician can do to make fewer resources do sixty percent more.

Just what our communication problem is now becomes obvious. Man long ago invented communications because he had something to communicate. He was terri-

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bly hungry; and he only used communication when he had a vital need. He develops effective communication capability only when he has both an enormous need and a clear idea of what his problem consists. To keep aware of the progressively most critical problems of humanity one must keep an eye on a complex of economic and technical development curves. As I told you the other day, when Eisenhower was confronted by his atomic advisors regarding the enormity of the hydrogen bomb, he said, "There is no alternative to peace."

I will give you figures that will bring you to last week's U.S.A. inventory of destruction. For each one of us, in the U.S.A., there are now ten tons of steel and twenty tons of concrete and one hundred pounds of copper in use. But, for every human being on the face of the earth today, we have now twenty-eight thousand pounds (T.N.T. equivalent) of explosives—that's fourteen tons per capita, which is to say that for every pound of human flesh there are two hundred pounds of self-annihilating explosives. We must move swiftly to convert that energy from negative to positive advantage before an Oswald puts his finger on the trigger of the omni-inter-retaliatory atomic bombing systems. If we have to wait twenty-two years for high standard living to develop secondhandedly from weapons development, the probability is high that the Oswald finger will trigger human annihilation.

In addition to Eisenhower's "no alternative to peace," I go along with two other statements. A physicist of Chicago University, John R. Platt, surveying general world trends and basic data, says, "The world is now too dangerous for anything but Utopia."

Unfortunately, we now view Utopia as unfeasible. Our attitude is derived from the fact that all attempts to establish Utopias occurred when there wasn't enough to support more than one percent of humanity, whereas it is fundamental to Utopia that there must be enough for all. For the last ten years the by-product more-with-lessing of prime weapons development has made it visible that there can be enough to go around—handsomely.

I also go along with the statement of Jerome Wiesner, who was the White House Advisor to Kennedy and to Johnson during his first term. Wiesner is now back at M.I.T., where he is head of the department of nuclear physics. Wiesner says, "The armaments race is an accelerating downward-spiral to Oblivion."

So I'll say to you that man on earth is now clearly faced with the choice of Utopia or Oblivion. If he chooses the latter he can go right on leaving his fate to his political leaders. If, however, he chooses Utopia, he must get busy very fast.

For this reason I am excited over the earnestness of this meeting. Our intuitions are powerful in bringing our reasoning to bear. So, here we are, suddenly discovering what the real world problems are: So long as there is not enough for all of humanity to survive and enjoy total earth, there will be war.

We now know that Malthus is wrong and that there can be enough to go around if we up the performances per pound of the world's resources from the present overall mechanical efficiency of world societies' mechanics to a highly feasible overall efficiency of only twelve percent.

This can only be realized through a design science revolution of spontaneously coordinate university-aged youth. This revolution is trying to articulate itself everywhere. It gets bogged down by political exploiters of all varieties.

Making the world resources adequate can't be accomplished through political system competition. All politics are obsolete as fundamental problem-solvers. Politics are only adequate for secondary housekeeping tasks. Mankind must take the universal initiative in effecting the design revolution.

You, of this world conference, Vision 65, at Southern Illinois University, are experts on how to communicate. This is the message that you must communicate to the world society in time to accomplish Utopia before Oblivion occurs.

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Cut Laurels

ARTHUR FREEMAN

Among the last acts of the lady in the park
whose face is crumpled as a cabbage, and whose pinched eyes
glint like oysters in the settling dark,
has been in perfect silence to have gazed

past the unpardonable children churning turf,
the lovers tangled on the benches, the brisk prams
and chipper nannies, to the tarnished rump
of the benign brass stallion of a king of France

for thirty minutes; for three hundred years
rider and horse have seemed about to part,
such pedestaled impatience paws the air.
But execution is the tease of art,

and rather, the old lady it will be,
shouldering her sackcloth, who must rise,
resigned to living, and lag home to sleep
and die, as, ultimately, you and I.

✪ ARTHUR FREEMAN's new book of poems, *Estrangements,* will be published by Harcourt, Brace and World in the spring. He is now teaching at Boston University and completing a book about Thomas Kyd.

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Communications in Senegal

OUSMANE SOCE DIOP

Improved communication among men is a fundamental condition for human progress and universal peace. Following national independence, our young nations of Africa need most urgently, of course, economic and social development in order to improve the living conditions of our masses. Political independence must not be an end in itself: it must merely be the means of giving our people better food, better housing, better health, and decent training and education for the rising generations. From the beginning, we have understood that to achieve all this, we would first have to build and put into operation a complete network of all communication media—roads, telecommunication, radio, films, educational television—as well as provide lectures by rural extension agents and technical assistance experts. All of that for education, because without education it is impossible to meet our most pressing needs in economic and social development. Universal primary instruction on all levels of the population, even to the most remote village in the bush (the basic social unit of the country), proves to be the indispensable tool without which no economic development or social progress is possible.

The task is immense. Imagine that one-third of Senegal's national budget is allocated to primary education alone, and that in spite of this great sacrifice, outside the large cities, in the rural areas where ninety percent of our population lives, we are able to offer such education to only one-third of the children.

Until our rural masses all have received the rudiments of primary education, it is certain that no means of communication—whether it be by books, press, radio, cinema, educational television or rural extension workers—will be able to reach all the layers of our population.

Once all our children are in school, our masses will be open to all communication media, and thus to all possibilities of achievement.

We have made the following observation: the execution of our development plan has been most effective along the tar-surface roads and the major bush tracks, because there the settlements have schools and more numerous and varied means of communication with the rest of the country—by newspaper, radio, travelers' reports and the cinema.

However that may be, one thing is sure, without first educating the masses, no development will be possible. Through multilateral as well as bilateral assistance, machines, capital and experts have been made available to the people of the underdeveloped world. But it must be said that the results that might have been expected from such aid have not been forthcoming. Often it has been forgotten that it is necessary to start with the individual, raising him up from his ignorance through education.

After this preparation, the rural masses would be able to understand fully the need for economic and social progress and would wish to work toward it. The people could be trained to run the machines they are given, and to use them more effectively. Through education they would also be enabled to make wise use of money and other means of development. In short, with their own effort and the material put at their disposal by outside assistance, preparatory education would allow them to ensure their own economic and social development.

You see, therefore, the importance of

✪ OUSMANE SOCE DIOP, Ambassador to the United Nations from the Republic of Senegal, gave this address at the Vision 65 Conference held at Southern Illinois University last fall.

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communication as a factor in mass education. Through books, radio, movies, and talks by rural agents employed as instruments of education and technical training, the people must be given the rudiments of the elementary knowledge necessary in order to put to good use all the material factors of progress. For example, through films, talks given by rural extension experts, popular science pamphlets, radio or educational television programs, the masses can be taught how to use fertilizers and selected seed effectively, how to can, and how to improve farming and stockraising methods. It is obvious that man and his education are the basic elements of the economic and social progress of the developing world.

On the international level, the expansion of communication media is just as pressing a need as it is on the national level. As soon as possible, books, newspapers, cinema, educational television, lectures and cultural exchanges should be made available to all. In this way it will be possible to create and develop better understanding among continents, men and their respective civilizations. We should, without delay, proceed to take an exhaustive inventory of the artistic and cultural stock of all peoples in order to conserve it so that it may become a part of the universal civilization. Before the end of this century, this universal civilization should become the culture of all men on this planet.

We must become acquainted with all civilizations and all original cultures of all the races before they perish under the increasingly overwhelming pressure toward the international standardization of man.

In Africa, we have made a definitive choice to return to the original sources of our Negro-African civilizations in order to make our own contribution to the universal culture in which all human cultures must play a part. Our attitude on this matter has come to be called the "Negritude Movement."

This movement is, most certainly, a refusal on our part to withdraw from society. Soon after Senegal achieved national independence, President Senghor, speaking in Florence on what direction we would give to the evolution of our cultures, spoke of the creation of a universal culture in which we would join, not in an effort to mimic as perfectly as possible the canons and models of other civilizations no matter how illustrious they may be, but rather to bring our own contribution based on the most authentic sources of our own civilizations.

When we reach this final great meeting point of all human cultures, we do not want to attend as mere consumers, but instead as creators of civilization, thus paying our own quota to the universal heritage.

This attitude, moreover, intentionally or not, has been that of the Afro-Americans, I mean the Americans of African origin. Uprooted from Africa and transplanted onto foreign soil where, through the centuries, they have even forgotten their ancestral tongues, they turned inward. Then in the deepest inner meditation, they heard the reminiscing of their whole being, their whole soul. Instinctively, they created Negritude before the word was coined. They re-created the rhythms, songs and dances of Africa. They even reconstituted African philosophies and cosmogonies. Touching on this subject, I wrote the following not long ago, in a poem entitled "Tomango":

> Like the children of Israel
> Under the whips of the Pharaohs
> You have never forgotten
> The Land of the Ancestors.
> Despite centuries of estrangement
> The soul and tradition of Africa
> Spring suddenly
> From the rock of the merengue,
> From the triumphant pain
> Of the Negro spiritual,
> From the heart-rending chants
> Of Ella Fitzgerald,
> From the multicolored fires of Armstrong's trumpet
> And from the white-hot tom-tom beat
> Of your bursting drums.

Naturally, we realize the dangers of the Negritude movement. Pushed to a narrow sectarianism, in the end it would only become racism in reverse. Our friends in other continents are already fearing this, and we are as aware of it as are they. That is why

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we have now put precise limits on this cultural movement. We, in dealing with this human problem, have adopted the attitude which has been so brilliantly defined by the Hindu poet, Rabindranath Tagore. He said, "I want the fresh wind of every culture and of every civilization to waft freely through my abode, but not so strongly that I am blown away myself."

It must be stressed that our visions of the world must converge toward a solution of that great crisis of our contemporary history: namely, the existing imbalance between a fantastic scientific progress that has enabled man to destroy his planet with the atomic bomb and soon to walk around on the moon, while the progress of our moral consciousness has been static, if not open, retrogression. According to Bergson, "the overgrown body awaits an extra measure of soul, and materialism is in need of a mystique."

This "extra measure of soul" can only be brought to all peoples on every continent through an extension of our communication media so as to allow the whole range of human civilizations to communicate, to get to know one another, in order that a universal symbiosis, infinitely enriching to all peoples, may emerge. Is the beautiful white sunlight when refracted by a raindrop not made of thousands of rainbow-fires?

The mystique that the technical progress of today's world needs is first of all a revival of spiritual values, and then, a mystique based on brotherhood, mutual assistance and a more equitable distribution of the world's wealth for the sake of universal peace and above any national or individual egotism. We must remember that before the end of this century the world's population will have doubled owing to the magnitude of the present population explosion, and that the world of the year 2000 will be an extraordinary world in which one man out of every two will be an Asian, and that three-fourths of the non-Asians will be from underdeveloped countries. Thus, seven-eighths of the world population will be composed of men living in underfed countries, in ignorance, sickness and poverty. In contrast, there will be one-eighth of the human population living in the industrialized countries, highly developed, with ninety percent of the world's resources in their hands and a correspondingly high standard of living. That is the disturbing picture of the world in the next quarter-century, a world off-balance where, with every passing day, the rich get richer and the poor poorer and more numerous. The impasse and the danger are well known. They have been studied by competent experts who have weighed them to the nearest gram and measured them to the nearest millimeter; but despite the great alarm that was sounded in Geneva in the spring of 1964 during the United Nations Conference on Trade and Development, no positive step has yet been taken. One has the impression that our contemporary world is marching toward the final impasse, the apocalypse, impelled by the same Fate which struck the hero of an ancient Greek tragedy. He advanced step by step, closer and closer to death, fully aware of what he was doing but unable to stop himself. The chorus of spectators, as powerless as he, could only cry "alas" in sympathy.

If we wish to escape the final impasse and its apocalyptic consequences, we must bring it about that human communication and exchange, trade in particular, are no longer governed only by the law of profit, the law of the sea among fishes and the law of the jungle among wild beasts, but rather by the mystique of justice, mutual assistance and universal peace for the general welfare of all mankind.

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On Intellectual Gloom

LYNN WHITE, JR.

Like any other community, the worldwide fellowship of intellectuals has its folklore, that is, things so commonly said that they are commonly believed. Bavarian peasants know that if you write the magic square

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R O T A S

on a piece of paper, and then tear the paper into tiny bits and mix them with a dog's food, it is a first-rate vermifuge as well as a notable example of applied humanism. They also tell you that some mushrooms are edible whereas others are poisonous. Intellectuals can segregate these bits of information quite easily into folk superstition on the one hand and folk wisdom on the other. But intellectuals have more difficulty screening the folklore of their own group.

On the surface, these days we discuss many things: nuclear power and the problem of controlling it in a world of sovereign states; the tidal wave of population and how to stem it without violating individual dignity; the widening gulf between the industrial nations and those "emerging," and whether it can be bridged without wiping out all cultural distinctiveness; the surge toward abstraction and subjectivity in all the arts as well as in philosophy, and the problem of renewing communication between artist and philosopher on the one hand, and their publics, on the other; the approach to a classless culture in the economically advanced nations, and the question whether this is the prelude to an age of faceless conformists. The substratum of all of these questions is: Are humanistic values viable in a world more and more dominated not so much by science as by applied science, by technology? Must the miracle of the person succumb to the order of the computer?

But even the new, and newly trite, metaphors of the humanists are drawn from science and technology. Everyone at times feels that the present explosion of specialized knowledge, not only in the natural sciences but also in humanistic disciplines and the social sciences, is a hydrogen bomb blasting the unity of the human intellect. As the universal cliché has it, we know "more and more about less and less." Just as astronomers, studying the "red shift," tell us that each galaxy is drawing away from every other galaxy and retreating into its own lonely infinity, so with the speed of light human minds are losing contact with each other. Our thinking has got spread over so vast a range of things that it is suffering excess intellectual entropy. Wistfully we yearn for new Aristotles and Leonardos, well knowing that if they could return they would be as appalled as we at the new chaos of what once seemed the mind's cosmos.

Talk about such matters is permeated by a folklore of dualistic demonism. We take it for granted that technology is a way of thinking and acting that is separate from, and hostile to, the humanistic effort to understand and foster the highest human values. Since humanists generally are more skilled and prolific in the use of words than are scientists and engineers, most of what is said is said somberly.

Despondency is so fashionable nowadays that to sketch a sunnier prospect seems philistine. The source of the current gloom, however, is not the objective facts but rather a subjective fact: to wit, that our

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inherited intellectual processes, emotional attitudes and vocabulary are no longer of much use for analyzing and interpreting the spiritual revolution going on all around us. We like to say that "education is learning to think." The truth is that education is learning to think in ways traditionally approved. The new world in which we live is so unlike the past, even the past that is close to us, that in proportion as we are saturated in the Western cultural tradition we are incapacitated for looking clearly at our actual situation and thinking constructively about it. The better we are educated, the more we are fitted to live in a world that no longer exists.

Ours is not the first age in which a once valid kind of education has become not only irrelevant but dangerous because of its irrelevance. The Roman senatorial aristocracy had an almost exclusively rhetorical education. In the days of Cicero and Caesar such schooling had enabled the Roman leaders to debate issues in the Senate with great clarity, and then to implement decisions for the conquest and rule of the Mediterranean. But the letters of Apollinaris Sidonius, Ausonius or Symmachus fifteen generations later show Roman aristocrats so miseducated in a revered cultural tradition that they could not formulate or discuss the living and entirely novel issues of the age of the Germanic invasions and the Christian mutation. Fortunately they were, at times, better than their education: Sidonius ended up as Bishop of Clermont, leading his people on the walls of the city in successful defense against a besieging Visigothic host.

Once more, in our own century, change has been rapid and basic but education and conceptual patterns have lagged. The old ideas often do not help us to understand and cope with the new situations. As a result there is a widespread sense of frustration among educated people because their expectation is so at variance with their experience. Quite naturally the gap is verbalized as disintegration and decay.

Such morose pontification, however, is based on a very limited selection among the facts of our time. The full view of the facts justifies not gloom but exhilaration. Our instinct for survival is proving stronger than our education. Like Sidonius we are *doing* better than we *think*. To my eyes, the facts fall into three general sets.

The first of these is *the move toward the center*. The explosion of knowledge and the speed of the trend toward specialization have produced a compensatory swing toward intellectual generality. This is best seen in education for the professions. It has become a commonplace that what a professional student learns in graduate school is largely obsolete by the time he gets his diploma. His training is of little continuing use unless it is combined with understanding of very broad areas related to his professional activity. Only by being more than a specialist can he remain an adequate specialist.

Medical education is a prime example. The general practitioner is a vanishing type: the bright young fellows in the white coats focus on specific organs or diseases. But equally—perhaps more—significant is the fact that whereas the old-fashioned general practitioner was graduated, as a rule, from a medical school physically removed and intellectually insulated from larger academic organisms, eight of the nine major medical schools established in the United States since World War II have been set up as integral parts of the campuses of large universities. The top professionals in the medical world are nearly unanimous that physicians and surgeons should be educated today in intimate conjunction with the whole range of the sciences, the social sciences, and even the humanities.

Similarly, while law schools were once encapsulated, content with their traditional concerns, they are now reaching out to relate themselves, by joint appointment of professors and in other ways, to philosophy, political science, history, sociology, and the other professional schools. Business schools, which even a few years ago were largely factories producing bland young corporation executives, are now much more sophisticated organizations studying social psychology, electronic systems, data processing, and a vast variety of

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matters far removed from their original functions but involving them with other parts of their universities. Schools for training teachers, so long looking inward at teaching methods, have suddenly turned outward toward the substance of what is taught. Divinity schools, striving to educate a clergy capable of understanding and meeting the spiritual needs of our time, have vastly diversified their interests. Led by the Juilliard School of Music in New York, which concluded that musicians must also be educated persons and therefore developed a wide offering in the liberal arts, our conservatories of music, art, theater and the dance either have become more than technical schools or else have joined with universities providing the studies needed to amplify the intellectual vision of their students.

Related to all this is the current growth of adult education, and, at the highest level, of postdoctoral study. Much of this is stimulated by the swift obsolescence of information and skills. More of it, however, rests on the mounting conviction that the best professional is best because he is more than a professional; that the essential skills are a capacity for getting an overview of what one is doing, of achieving abstraction from it and mobility in relation to its accepted presuppositions and methods.

Intense specialization, then, is only one aspect of the intellectual revolution of our time. Equally significant is a massive gravitation toward common concerns. This is not something that *should* happen: it *is* happening on a stupendous scale involving huge investments of capital and human devotion. The move toward the center is fundamental to our thinking about ourselves and our time.

The second major pattern of intellectual growth, as I see it, is closely related to the first: it is *recognition that technology and science are, and always have been, integral to the human adventure,* and not things curiously alien from the concerns of our race.

It is said that after the ceremonies dedicating the great telescope on Mount Palomar, someone remarked to an astronomer, "Modern astronomy certainly makes man look insignificant, doesn't it?" To which the astronomer replied, "But man is the astronomer!"

Nothing in nature that a scientist can study is more significant or puzzling than that part of nature that is the scientist himself. Why does he bother to become a scientist? Having bothered, why does he act as he does? How do the structures of his culture shape his work as a scientist, and vice versa? Until very recent years the history of science—which is to say, the scientific examination of the scientist—has been amazingly neglected. But within the last decade or so it has begun to win wider recognition. Even more recent and sudden is the worldwide growth of interest in technology as something to be understood as a human activity if we are to have total access to ourselves as spiritual beings. In 1958 the Society for the History of Technology was established, with a quarterly journal, in the United States. During the past four years new centers for the history of technology have been set up in Europe, especially in France and Italy. We have now begun to mine the veins of humanistic insight awaiting us in the substance not only of pure science but also of technology. Even humanists educated in traditional patterns have generally admitted that Gutenberg's invention, for example, had humanistic implications. It is only recently, however, that we have begun to understand and get excited about the inside technical details of the creative process by which this skilled metallurgist brought his arts to bear on a complex problem and thus produced a device essential to the democratic revolution of our age.

Which brings me to the third pattern in the movement of thought in our generation: *the building of a democratic culture* that expands, supplements and modifies profoundly our inherited aristocratic culture. The problem we face is very like that which faced the Roman Empire when Christianity became religiously dominant and demanded not a junking of the inherited pagan culture but rather a reworking of it in terms of new presuppositions.

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Education has always been largely functional in intent, and in the past it has done two things for society: it has taught the aristocracy how to rule; and it has helped to stabilize the social structure by giving students a distinctive intellectual costume which separated them from those who were not aristocrats. These costumes were often of great elegance and are of continuing aesthetic value. The inertia of our educational systems is such that we still enjoy the company of many clothed in knee breeches, tricornes and swords, some in hauberks, and a few almost in togas.

In the past the aristocracy has patronized certain activities in which aristocrats themselves have seldom participated intensively, and which therefore have not generally been part of aristocratic education. These were science (apart from mathematics), technology, and the creative arts. They all involved using the hands and thus were beneath the dignity of the educated man. Today in the industrial nations, however, we are far advanced in building a political and economic democracy which already has destroyed the old use of physical costumes to distinguish social classes. We are now unifying our mental costumes. We are pushing on to break the barriers between types of human experience and kinds of values—barriers which, viewed historically, were largely social. Quite unconsciously, for the most part, we are on the way toward building a new sort of humanism that encompasses in its sympathies all kinds of creativity, including those involving hands as well as brains.

Just to give one concrete example: immense scholarly energy has been expended on Machiavelli, Ficino or Valla, and one begrudges none of it. Yet how many educated people realize that fifteenth-century Italy produced innovations in machine design that in their own way are quite comparable to the Renaissance achievements in other fields? Few of the extant notebooks of Italian engineers prior to Leonardo have been published. I have examined some of the manuscripts, and find in them an excitement, an originality, and an implication for the life of our race during the five hundred years since then that make them the match of any body of material traditionally revered and studied. The building of a democratic culture to crown our political and economic democracy is not a matter of scrapping the treasures of the aristocratic past (although some smelting and recasting is inevitable) but rather of understanding *all* aspects of the human enterprise including those traditionally little admired because they were marginal to the aristocracy.

The move toward the center; the recognition that science and technology are integral to mankind's adventure; the building of a democratic culture: these are clearly only three aspects of one thing that is occurring—the achievement of a unity of human knowledge and experience such as no earlier age has imagined. I decline to bewail gathering gloom, the stagnation of excess entropy. The evidence of my eyes shows me a tide of the mind that is the exact reverse.

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The Creative Use of Leisure

WILLEM SANDBERG

children when young
start scribbling:
registrate movement with pencil
often without looking

afterward they define
definition of man:
body, head, two arms, 4-7 fingers
two legs, toes
often a hat and body with buttons

then, when given material
they express:
strong colors
trees, houses, faces, animals
—show work proudly

if not given material
beware of your walls!
expression is necessity

suddenly, with puberty,
inspiration stops
they start to copy
nature or a postcard

the moment has come
to integrate in society
to adapt

the majority remains at this stage as adults
follows tradition
society is based on these

the few, the inventors
in science and arts—the real leaders—
create new traditions

to keep society going
we need a large percentage of integrated
followers of tradition
and a small minority of creators
not integrated inventors

let us look at the artists
but first define
and call artists

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who create anew make a stop ahead
never think about making art
but solve a problem
—inspired by life

many who call themselves artists
don't contribute to renewal
—not inspired by life but by art
form the school

i would not call them real artists
but painters and sculptors
they people madison avenue

society develops

each phase is registrated
by artists

lautrec symbolizes
the end of the bourgeois era decadence
vincent expresses
the new relation between man and man

sees nature
as violent reflection of our feelings
does not look at his objects from outside
like impressionism
identifies himself with his subjects
—socialism

mondrian crystallizes the elements
builds new space
with lines straight
colors primary
rectangular forms

we believed in rectilinear development
some 50 years ago

jackson pollock
did not identify himself with a subject
but with his painting
not preconceived

as our senses are not adapted
their work hurts, shocks
seems hideous

their products

more easily digested by the public
are called beautiful

there is no independent line
in the development of art
rembrandt does not stem from rubens
vermeer does not come from rembrandt

van gogh in arles
does not follow manet or monet
mondrian does not develop vincent
de kooning and appel
are no prolongation of mondrian

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but growing with his action
abolishing distance
between artist and work
perspective

impossible
to trace a line
from monet by van gogh
and mondrian to pollock
to derive one from the other

there is no history of art
but a history of society
of which art
is the image

the artist
the moment he solves his problem
starts to copy himself
follows the taste of the public
is no longer leader
becomes a painter, a sculptor
successful, integrated and social

very few
heading for a faraway goal
may continue during a lifetime
with a climax of freedom at the end

titian greco rembrandt
klee mondrian bonnard died great

they have passed
the most severe test:
success

real art is not a matter of talent
but of character

let's now turn to the majority
the public
hungry for communication
and swallowing TV and sundaytimes

youngsters hang around
alone or in gangs
make mischief
try to display energy
not knowing for what
discontent
thank god

adults
polish the car
drive around without purpose
quarrel
busy themselves with TV
satisfied with pastime
a pity

creative use of leisure is rare

time means measure of life
to live, to love, to work, to create

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we need time

better distribution
of the products of labor
and sparetime to enjoy them
are great achievements

we have entered a new era
we have acquired the freedom
to re-create life
to become self-made

but progress
is not a question of inventions, of
possibilities but of generations

majority
not prepared for the creative use of leisure
wastes time

do we prepare the coming generation?
the school?
where have all our gifted children gone?

there are three forms of education

1. by a person of higher authority
parents, teachers, the boss
2. by a person of less authority
parents by children, teachers by pupils, the boss by his employees
3. by a person of equal authority
in marriage, brothers and sisters, schoolmates, colleagues, teamwork

the greatest sin toward life
is pastime
boredom a curse
formerly monopoly of the privileged
today within everybody's reach

half of our time
we need for meals, sleep
and transport between home and job

when i was young
the majority spent the other ½
on the job itself—24 hours

now one needs only 42 hours
to earn a living—here even less
¼ of the 168 hours that make our week
of the other ¼ we dispose freely

do we fully realize what this means
for the whole population?

education does not stop at 15
it goes on
till we are no more able to learn from
life

no. 3 teamwork
by far the best
leaves the least resentment
no. 2 parents by children
might do
i don't resent my education
by my children or my employees

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no. 1 higher authority
is the worst
and most in use
favored by tradition
organized by society

the word education smells bad
i prefer instruction
pure matter of communication

teachers should become
more and more instructors
stimulating juniors
to educate each other
with the aid of
new methods of communication

such teachers
able to give instruction plus example
are rare
everybody capable should be available
we will have to pay the price

i could imagine
university without professors
but no school without teachers

progress starts there
integration of youngsters
into the new era
aware of the creative use of leisure

inventions have created the possibilities for a new era!

the era of the atom
exploration of space
new perspective
possibilities of new democracy

the era of creative use of leisure

wars are rapids in history

economic relations change faster
barriers between groups fade
prejudices disappear
far away peoples gain freedom

these basic changes
demand adaptation of social institutions
as yet not realized

we watch
new life, often wild
in youth and in art

rock 'n roll, blue jeans

blousons noirs, the beatles

actionpainting, *l'art informel*
experimental art, abstract expressionism

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pop and op
have killed the legend of "fine arts"

the artist plunges with abandon
into the unknown
in order to render visible, palpable, audible, perceptible
new life approaching

true art at its birth
exacting and ill-bred
does not speak but shouts

living with young art
makes us feel at home in our time

digging deeper
into the problems solved by our artists
we find our problems

for us art—laboratory of research
in the field of communication

the artist does not worry
about the utility of his solutions
we do

we may use communication
to develop the creative use of leisure

our vision
the integration of the new generation
in the new era

✪ WILLEM SANDBERG, a typographic designer and former director of the Stedelijk Museum in Amsterdam, Holland, is presently the organizing director of the Israel Museum in Jerusalem. Mr. Sandberg spoke at the Vision 65 Conference.

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The Logic of the Mind

J. BRONOWSKI

I am honored by your invitation to speak, under the auspices of two famous societies, to this meeting which marshals the whole diversity of American science. I am honored to speak in a series that has the admirable title *Science and the Other Humanities,* and I am also and rather particularly grateful. I am grateful, of course, that you have asked me here, a newcomer to the American scene who is still at the delightful stage of being bewildered by the unexpected range and the energy of your scientific interests.

Yet when I said that I am particularly grateful, I had a second reason in mind. It is this. A man of my preoccupations, that is, a practicing scientist with a passion for literature, is often asked to speak about the relation of science to literature. But usually he is constrained, by the broad nature of his subject and of his audience, to speak in very general terms. I feel no such constraint tonight. There cannot be an audience anywhere in the world more deeply devoted to science, and to the play of the human mind in experiment and invention, in logic and imagination, than this great gathering. That gives me the chance to speak more searchingly and, as it were, more professionally about my subject than usual; and I take that chance gratefully.

I gave a series of lectures early this year at the American Museum of Natural History in New York on science and literature as modes of knowledge, which were published last month as a book under the title *The Identity of Man.* There are a few places here and there in the book (I think I count four) where I should have liked to speak more fully and more circumstantially, had I been speaking to a professional audience. I shall single out one of these places, which sketches what may be called the machinery of the mind, and make it the occasion for a larger analysis tonight. I hope to develop the others on other occasions.

The mind is an elusive entity, whose workings are not wholly confined within the brain. But because I am looking at the logical processes of the mind, it is fair that I concentrate in the first place on the brain as the organ in which these processes must be mechanized. The subject of how the mind works as a mechanism, what machinery we can imagine to operate within the brain, has its intrinsic interest in any case. We know that the brain is made of the same stuff as the rest of nature, and its atoms must therefore obey the same natural laws as other atoms do. In that sense, then, it is tempting and even reasonable to say that the brain must be some kind of a machine. But alas, to use the word *machine* in this catch-all sense misses the crux of the question. The real question about the human mind lies deeper: it asks, Is the brain a machine with a formal procedure of any kind that we can now conceive? Let me quote a pertinent passage from *The Identity of Man.*

> A machine is not merely a whirring train of gears or a humming set of electric circuits. These happy, busy strings of hardware are only the middle step, the visible link, in a procedure which has three steps, and to which the other two are as integral as this is. The machine is

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the procedure, and the whole procedure, all three steps of it. The first step is the instruction or input, which is the modern form of the button that starts the machine: and which must itself be precise and mechanical, an unequivocal set of holes or marks on a tape that directs the machine into one branch of its network of possible paths. Then comes the physical machinery which obediently carries out the instructions and turns them into actions. And the third step is the result or output, which is equally decisive and definite: in a computer, it is another set of holes or marks on a tape.

It is of cardinal importance here, and essential to my description, that the output from a machine must be exact and unambiguous as the input is. For a modern machine, like a man, is asked in part to regulate itself, and for this purpose it must be able to instruct itself. Such a machine, or a man, must be able to feed its output back into itself as a new instruction. Its output must therefore be as sharp, within the tolerance of the machine, as capable of symbolic expression, as well defined and as single-minded as its input.

Our field of inquiry is the grey region between the input to the brain and the output from it; that is, between the information that the senses send to the brain, and the instructions or other decisions that issue from it. In this grey region, the brain manipulates the input and draws conclusions from it. During this process, the brain presumably uses some symbolism which translates and codifies its conceptions of the outside world. We do not know what this symbolic language is, but if it is indeed to be mechanical (on any system that we understand) its units must consist of configurations of atoms, and of changes in these configurations which are displayed as electrical signals. If then the brain reasons like a logical machine, these signs or units which it employs in its reasoning must constitute a formal language or series of languages which follow precise rules, just like the language of symbols in which we write out logical and mathematical arguments. The brain cannot be a machine in any sense that we understand unless its language is as strict and as artificial (in the logical sense) as any of our own marks on a magnetic tape.

The symbols with which the brain works, its language (or successive languages), are physical, chemical and electrical. But this makes them no different from marks on a paper or on a tape. Provided that they are exact, and are always translated exactly in the same way, they constitute a formal logical language. What is to be said about them, then, comes not from physics and chemistry and biology, but from symbolic logic. This is why I, a mathematician, presume to talk about it to physicists and chemists and specialists in biology.

We know a good deal now about symbolic languages and the logical procedures that they can express which was not known when I took the Mathematical Tripos at Cambridge in 1930. There were two of us who offered what was called Mathematical Philosophy that summer: Max Black and I. The man who had lectured to us had been the prodigious, prodigal Frank Ramsey. But he had died early that year, a month before his twenty-seventh birthday, and I imagine (although I cannot be sure) that we were examined in his place by his friend Richard Braithwaite. Whoever the examiner was, he blandly asked us on one of our papers to discuss the *Entscheidungsproblem*.

The *Entscheidungsproblem,* the problem of decision, was a startling question which David Hilbert had posed: whether it is self-evident—whether indeed it can be shown—that all mathematical assertions that make sense can necessarily be proved to be either true or false. The question had gone unanswered for a long time, and neither Max Black nor I was likely to settle it at short notice in an afternoon. I no longer remember what general arguments I produced in the examination room for and against the disputed possibility. For history caught up with us and our examiner in a spectacular way, ironically within a year.

Most professional scientists now know what happened. In 1931 a young Austrian mathematician, Kurt Gödel, proved two remarkable and remarkably unwelcome theorems. The first theorem says that any

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logical system which is not excessively simple (that is, which at least includes ordinary arithmetic) can express true assertions which nevertheless cannot be deduced from its axioms. And the second theorem says that the axioms in such a system, with or without additional truths, cannot be shown in advance to be free from hidden contradictions. In short, a logical system that has any richness can never be complete, yet cannot be guaranteed to be consistent.

That was in 1931. In the next few years, other unpleasant theorems were established. A. M. Turing in England and Alonzo Church in America showed that no mechanical procedure can be devised that could test every assertion in a logical system and in a finite number of steps demonstrate it to be either true or false. This is Hilbert's *Entscheidungsproblem* in its direct form. In a sense, Gödel's result is deeper than this; and Alfred Tarski in Poland proved an even deeper limitation of logic. Tarski showed that there can be no precise language which is universal; every formal language which is at least as rich as arithmetic contains meaningful sentences that cannot be asserted to be either true or false.

In order to leave no room for doubt, let me linger on the essential content of these extraordinary and far-reaching theorems. They are theorems in mathematical logic, and in one sense the mathematics cannot be removed from them. That is to say, any logical system to which they apply must include the arithmetic of whole numbers as a basic and distinguishable part. But with this proviso, to which I shall return, they apply to any system of thought that attempts to set up a basis of fundamental axioms and then to match the world by making deductions from them in an exact language—the language of physics, for example, or the chemical language inside the brain.

Such a system of axioms has always been thought to be the ideal model for which all science strives. Indeed, it could be said that theoretical science is the attempt to uncover an ultimate and comprehensive set of axioms (including mathematical rules) from which all the phenomena of the world could be shown to follow by deductive steps. But the results that I have quoted, and specifically the theorems of Gödel and of Tarski, make it evident that this ideal is hopeless. For they show that every axiomatic system of any mathematical richness is subject to severe limitations, whose incidence cannot be foreseen and yet which cannot be circumvented. In the first place, not all sensible assertions in the language of the system can be deduced (or disproved) from the axioms: no set of axioms can be complete. And in the second place, an axiomatic system can never be guaranteed to be consistent: any day, some flagrant and irreconcilable contradiction may turn up in it. An axiomatic system cannot be made to generate a description of the world which matches it fully, point for point; at some points there will be holes which cannot be filled in by deduction, and at other points two opposite deductions may turn up.

The implications of these results for any theory of knowledge have long been stressed, for example by Rudolf Carnap and by Karl Popper. But in addition I am stressing here, as I have done before (in *The Common Sense of Science* in 1951), their implications for empirical science. For I believe that any exact science must include in its system the axioms of arithmetic, in the form of procedures that require us to distinguish all the whole numbers. For example, if we seek to reduce all the sciences to physics, then we shall need the theory of groups and the statistics of assemblies of particles; and both these operations are subject to Gödel's theorems. In the same way, the statistical limitations on the recurrence of physical systems which Henri Poincaré first demonstrated in ergodic theory are, in my view, another expression of Turing's and Church's theorem that it is impossible to decide for every instance whether it is a consequence of the axioms. And finally, Tarski's theorem demonstrates, I think conclusively, that there cannot be a universal description of nature in a single, closed, consistent language.

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I hold, therefore, that the logical theorems reach decisively into the systemization of empirical science. It follows in my view that the unwritten aim that the physical sciences have set themselves since Isaac Newton's time cannot be attained. The laws of nature cannot be formulated as an axiomatic, deductive, formal and unambiguous system which is also complete. And if at any stage in scientific discovery the laws of nature did seem to make a complete system, then we should have to conclude that we had not got them right. Nature cannot be represented in the form of what logicians now call a Turing machine —that is, a logical machine operating on a basic set of axioms by making formal deductions from them in an exact language. There is no perfect description conceivable, even in the abstract, in the form of an axiomatic and deductive system.

Of course, we suppose nevertheless that nature does obey a set of laws of her own which are precise, complete and consistent. But if this is so, then their inner formulation must be of some kind quite different from any that we know; and at present, we have no idea how to conceive it. Any description in our present formalisms must be incomplete, not because of the obduracy of nature, but because of the limitation of language as we use it. And this limitation lies not in the human fallibility of language, but on the contrary in its logical insufficiency.

This is a cardinal point: it is the language that we use in describing nature that imposes (by its arrangement of definitions and axioms) both the form and the limitations of the laws that we find. For example, it may be held that if we can remove the arithmetic from physics, we may yet get an axiomatic system which is complete and consistent. I do not share this view, but it is arguable; yet it does not seem to me to bear in fact on our present formulation of the laws of nature. On present evidence, we must conclude (in my view) that the human mind is constrained to conceive physical laws in arithmetical language: the whole numbers are literally an integral part of its conceptual apparatus. If this is so, then the mind cannot extricate the laws of nature from its own language; and we are not at all, as Leibnitz and others have thought, in a "pre-established harmony" with the language of nature.

Every scientific system as we understand that phrase now is incomplete: simply as a logical machine, it cannot cover all the phenomena of nature. It therefore follows, not merely in practice but in principle, that the system must be enlarged from time to time by the addition of new axioms, which cannot however be foreseen or proved to be free from contradictions. How does the outstanding scientist come to propose such a decisive axiom, while less imaginative minds go on tinkering with the old system? How did Gregor Mendel leap to conceive the statistical axioms of genetics? What moved Albert Einstein to make the constancy of the speed of light not a consequence but an axiom in the construction of relativity?

An obvious answer is that the great mind, like the small, experiments with different alternatives, works out their consequences for some distance, and thereupon guesses (much like a chessplayer) that one move will generate richer possibilities than the rest. But this answer only shifts the question from one foot to the other. It still remains to ask how the great mind comes to guess better than another, and to make leaps that turn out to lead further and deeper than yours or mine.

We do not know; and there is no logical way in which we can know, or can formalize the pregnant decision. The step by which a new axiom is added cannot itself be mechanized. It is a free play of the mind, an invention outside the logical processes. This is the central act of imagination in science, and it is in all respects like any similar act in literature. In this respect, science and literature are alike: in both of them, the mind decides to enrich the system as it stands by an addition which is made by an unmechanical act of free choice.

As for the invention that is added, the new relation in science or the imaginative

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shift of vision in literature, its birth is always the same. It begins in the multiple meanings and overtones, the hidden ambiguities, which human language contains in spite of our best efforts to make it sharp. The language of thought consists for the most part of general words, and although such a word may be as matter of fact as *parallel* or as solid as *mass,* as down to earth as *table,* there is always about it a penumbra of uncertainty and ambivalence from which new relations may suddenly become apparent. *Parallel* may become the beginning for non-Euclidean geometries, and *mass* may become equivalent to energy, for the universal reason that even a *table* cannot be defined in terms that allow us to say with absolute decision of every object in the universe that it is either a table or not a table. Frank Ramsey, of whom I spoke earlier, proved that this is an indispensable factor in the development of any science; and in this important sense, he anticipated some of the implications of Gödel.

It is characteristic of human language that it is made up of past metaphors and analogies, and they are a fertile ground for the exploration of ambiguity and the discovery of hidden likenesses. Here begin the unexpected links and conjunctions which literature (and all art) constantly produces; and the inventive ideas of science begin here too.

As to how these ambivalences are developed in science and in literature, that is the theme of *The Identity of Man,* and I can only summarize it here. In science, the aim is to disentangle each ambiguity, and to force nature to decide between the alternatives by a critical experiment. In this way, we progress in science (as it were) by turning the information from nature through the logical machine of the brain into an effective tape instruction. In literature, the ambiguities are not resolved, and the brain works or plays with the information without ever turning it into a machine instruction. But in both, the new invention is taken by the same kind of step, and at the moment when the step is taken, we are in no logical system: we have left one system and are about to enter and form the other, and are in a no-man's-land outside logic.

The first half of my theme, which I have now completed, has consisted of theorems in mathematical logic and their application first to the language of science and then, incidentally, to literature. What I have shown there, the surprising demand that they imply for a kindred imagination in both, is unsettling, of course, and awkward, because this is not at all how we wanted the grand panorama of knowledge to look. But there it is, we must come to terms with it; and so far, I have simply displayed what the terms are, as a matter of fact.

Now I turn to the second part of my theme, to discuss a sharply different aspect of the same problem. I shall still be concerned with these maverick theorems in logic, but with something else about them: not so much with their existence and implications as with their origin. For there is a common source from which all these theorems spring, and it is uncommonly interesting and revealing.

Specifically the two theorems of Gödel, the theorems of Turing and Church, and Tarski's theorem say different things. Each of them establishes some limitation on a logical system, either on its completeness or its consistency, and these limitations are not quite the same. Yet they do form a common family of limitations, and this is because they all arise from a common difficulty in all symbolic language. The difficulty is that the language can be used to describe not only parts of the world, but also parts of the language itself.

Many logical problems grow from this common root, namely that the range of reference of any reasonably rich system necessarily includes reference to itself. This creates an endless regress, an infinite hall of mirrors of self-reflection. And the regress comes sharply to a focus in all the paradoxes of logic, which are cousins of one sort or another to the classical contradiction that the Greeks knew: what they called the Cretan paradox. This is the con-

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tradiction implied by the statement of Epimenides the Cretan that all Cretans are liars.

There are many modern forms of this and its related paradoxes. One form is Bertrand Russell's definition of the class of all classes that are not members of themselves. Another is the paradox of Jules Richard, which (roughly) gives this a numerical dress: Gödel constructed his theorems on this pattern. Perhaps the punning, linguistic quality of these contradictions, their oddly literary playfulness, is best displayed by a remark in the same vein by Groucho Marx, who said that he would not think of belonging to a club that was willing to have him for a member. Yet these are not trivial matters: they face us whenever we contrast rules and exceptions, tolerance and intolerance, and all the human issues that join and divide us in argument at the same time.

The mathematical paradoxes, and the devices derived from them that Gödel and others exploited for their theorems, all have the same feature: they depend on the use of concepts whose range of reference includes the concept itself. In short, the model for them all is the Cretan paradox, the simple sentence, "What I am now saying is not true." This is obviously a self-contradiction: if the assertion is true, then by its own evidence it is not true; and if the assertion is false, then that tells us that what is being said must be true.

Bertrand Russell tried (with Alfred North Whitehead in the *Principia Mathematica*) to untie the knot in this kind of paradox, and to put an end to the infinite regress of assertions about assertions, by constructing a theory of types. This was intended to prevent us from using the same language to discuss our language as we use to discuss the things that the language names. A hierarchy of types was created, starting with simple sentences about things, going on to sentences about sentences about things, then to sentences about sentences which are themselves about sentences about things, and so on. No one could look on this infinite construction with anything but a suspicious eye, and so it turned out; the theory of types is an unhappy artifice. If as human beings we want to use human language, then we must accept that part of its richness is in its capacity to refer to itself.

I stress, in what I have just said, the word *human*. Animals use language to signal to one another, and what they have to say essentially refers to states of affairs (factual or emotional) and to nothing else. Such a language has no problems of self-reference: it is intended to pass information from one animal to another, directly and unequivocally as an instruction. In this sense, René Descartes was right to say that animals are machines and human beings are not. Human language is richer precisely because we think about ourselves. We cannot eliminate self-reference from human language without thereby turning it from a genuine language of information into a machine language of instructions.

In particular, all philosophy and epistemology operates by its nature within the field where the difficulties lie, the field of self-reference. I mean by self-reference the construction of sentences, in thought or in speech, whose range of application includes that very kind of sentence. On this definition, "I am hungry" contains no self-reference, but "I am troubled" does. All thinking about thinking implies self-reference: the first statement of principle in the philosophy of Descartes, *Cogito ergo sum,* refers to itself. It is this very cogitation, or the class of cogitations that includes it, that gives the speaker the right to assert that he is cogitating. Philosophy is not possible without the regress of cogitation about cogitation. Whatever could be thought by machines, philosophy certainly could not. Indeed, on my view of human language, philosophy could not even be thought about by animals.

It is clear enough that statements in philosophy are, by their nature, often dogged by self-reference, and that philosophy as a discipline is therefore limited even more severely than science by the logical gaps that the theorems of Gödel and Tarski have laid bare. In mathematics and science, it is a surprise to find oneself bounded by

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these theorems; it is not at all obvious, and indeed is unexpected, to learn that mathematical and scientific statements cannot be wholly cleared of self-references (or of some equivalent recursive regress). But it is evident from the outset that philosophy is full of self-references, and therefore that, if the breakdown in the machinery of logic has its origin in self-reference, then philosophy is surely subject to it. Indeed it is clear that, while mathematics and science are subject to it only from time to time, when a new step has to be taken, philosophy is subject to it severely and constantly—because self-reference is built into its very method.

In the same way, we can see at once why psychology and psychoanalysis, regarded as sciences, are most severely subject to the theorems of logical limitation. There was a time when no clear boundary was drawn between philosophy and psychology; Thomas Hobbes, John Locke and David Hume all wrote philosophy much of which was a study of the mind, and was, for its age, a form of psychology. Now that psychology has entered into less conscious fields of the mind, the logical problems that are created by self-reference are very patent. Many natural scientists complain that psychology, and other studies of human thought and behavior, lack the rigor of a true science. This is usually excused on the ground that such human studies are young, and have not yet developed the proper formal apparatus by which information can be turned into exact prediction. But I suggest that the logical theorems now show us that this excuse is mistaken. There is an essential difficulty in casting these disciplines into an axiomatic system; they are limited, more severely and more constantly than the natural sciences, by the self-reference that underlies them everywhere. And it cannot be got out of the system by the occasional addition of a new axiom, as in the natural sciences. The axiomatic method as such may be unworkable in these studies, and whatever machinery is discovered for them in the future will (I think) not be of this traditional kind.

This is illustrated by Karl Popper's account of how he became disillusioned with the psychoanalytic explanations of Sigmund Freud and Alfred Adler. In natural science, remarked Popper, a theory is expected to make a prediction, and one prediction only, about the outcome of an experiment; and it is discarded if this forecast is not fulfilled in the experiment. But the theories of psychoanalysis are not of this kind at all; as Popper found, they are constantly explaining that my neighbor on the right is polite because he has an inferiority complex, and my neighbor on the left is rude because he has an inferiority complex. If therefore I turn the concept of the inferiority complex around, I get the unhelpful prediction that it may cause my neighbors either to be polite or to be rude. This is not what we expect of a scientific theory. And indeed it is not: all arguments derived from Freud's invention of the unconscious have this paradoxical content, precisely because their use of self-reference creates paradoxes. The Cretan who said that all Cretans are liars was talking a classical form of the language in which the psychoanalyst frames such concepts as the unconscious and its inferiority complex. If he had lived not in Crete but in Vienna, he would have said that all Viennese have inferiority complexes.

Beyond these borderline fields stands, full face, the particular interest to which I am drawn: the art of literature. A work of literature is in the first place a description or a story: William Wordsworth's poem "The Daffodils" is a description, and the *Oedipus Rex* of Sophocles is a story. Neither a description nor a story need contain any overt self-references. For example, the description of my interests and the story of my career that are set out in the program of this conference are neutral accounts which do not demand that you involve yourself in them by referring any part of them to yourself. Unhappily, when that has been said about this description and this story, nothing at all has been said either about "The Daffodils" or about the *Oedipus Rex*. Yes, it is possible to have de-

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scriptions and stories whose content does not draw us into them, and in which our minds do not reflect on themselves. But as these program entries show, such accounts simply do not have the power of Wordsworth and Sophocles. Neither, I am afraid, will they have their immortality.

From these simple examples it is at once clear that literature is literature only when it demands and commands our personal involvement. It is insistent because it insists that the bland descriptions of flowers and the remote *Police Gazette* records of incest and suicide concern us. They become part of us and we of them, they draw us to the human race and the human condition, and they make us one with Wordsworth on his couch and Jocasta in her bed and the plague-racked men of Thebes all over the world.

What is true of literature is true of every art. The work of art is a constructed thing, and is so even when it happens to have been found in nature in the form into which we now read a human meaning. It has been made in essence, its meaning has been created, by a human being: it expresses his vision of the relation between man and nature, and it invites us not to like it or to dislike it but to be drawn into it. The work of art compels us (when it is compelling) to look at the world with it, and to look through it into the mind of its maker. We cannot dissociate the work from its origin, which is to be a made thing—a thing made by a man which expresses how the man sees himself in the world. It interests us only as it engages us, and asks us to see ourselves in the same world also. Although what is expressed in the work is another man's self, the reference is to ourselves because the reference is universally to the human self.

Let me be explicit in my meaning here. I am not merely remarking that there is self-reference in the moral reflections of the Greek chorus, or in the reflections "in vacant or in pensive mood" that fill Wordsworth's inward eye in solitude. These are only of the same kind as the reflections of Descartes in philosophy and of an analyst interpreting dreams. But the self-references of literature, and of art in general, go deeper than these formal thoughts. My argument is that literature is composed essentially of self-reference, and takes its life from the dual tension between watching our own minds from the inside and watching someone else's from the outside. And this is one of the classical paradoxes in the theory of knowledge, how and when we know that others do indeed feel as we do, which Ludwig Wittgenstein for example discussed in the *Blue Book* long before I discussed it in *The Identity of Man.*

The force and meaning of literature is to present the lives of others to us in such a way that we recognize ourselves in them, and live them from the outside and from the inside together. We do not understand Wordsworth unless our heart also turns over at the golden host, and the tragedy of Oedipus differs from the gunplay in the Sunday paper only if we recognize ourselves in the characters. We have to see that Oedipus is us, capable of killing a stranger at the crossroads and blundering into a labyrinth of horror. We have to see that Jocasta is us, longing for the lost youth who so transparently is a part of herself in both senses: the son who is also the symbol of her own youth, that she longs to recapture and sense again in her leaping womb. And when we recognize that in Jocasta and in ourselves, it is more tender, more heartbreaking, more deeply human than the explanations of psychoanalysis. Of course Freud was right about the Oedipus complex; but Sophocles wakes deeper echoes than Freud, because he brings home to us the longing of Jocasta for herself—the self that she was and the self that she gave birth to—in the same hushed breath with the familiar and family jealousy of Oedipus.

Literature and art live by, they come alive in, the sense of our own self stretching into the actions and disasters of someone else's self, and thereby mapping the human self as a whole. This is how I put this part of my theme in *The Identity of Man.*

I hold that each man has a self, and enlarges his self by his experiences. That is, he learns

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from experience: from the experiences of others as well as his own, and from their inner experiences as well as their outer. But he can learn from their inner experience only by entering it, and that is not done merely by reading a written record of it. We must have the gift to identify ourselves with other men, to relive their experience and to feel its conflicts as our own. And the conflicts are the essence of the experience. We gain knowledge of our selves by identifying ourselves with others, but that is not enough—that only gives us the fantasies of sex and the parodies of power, the absurd strutting daydreams of Secret Agent 007 and *Butterfield 8*. We must enter others in order to share their conflicts, and they must be shown to have grave conflicts, in order that we shall feel in their lives what we know in our own: the human dilemma. The knowledge of self cannot be formalized because it cannot be closed, even provisionally; it is perpetually open, because the dilemma is perpetually unresolved.

Let me recapitulate the steps in my argument. I treated my theme in two parts: the first was concerned in the main with science, and the second with literature. In both parts, I was at pains to show that the brain as a machine is certainly not the kind of machine that we understand now. It is not a logical machine, because no logical machine can reach out of the difficulties and paradoxes created by self-reference. The logic of the mind differs from formal logic in its ability to overcome and indeed to exploit the ambivalences of self-reference, so that they become the instruments of imagination.

In the first half of my theme, I explained the limitations (they derive from self-reference) that circumscribe any axiomatic and deductive system of a reasonable richness, in mathematics and (I hold) in the natural sciences. The logical theorems which I quoted and explained show that this must be so, and they also show how these logical gaps have to be filled, and new theorems incorporated as added axioms in a system, at each step. The decision to take new matter into our systems, in science or in literature, has no analogue in any logical machine. It is an imaginative step of a kind that we do not understand, but that we can watch in the work of a great scientist or a great writer; and it is alike in science and in literature.

The second part of my theme goes further. Here I pointed out that human language, when it is specifically human, and is concerned with reflection and judgment about our own lives, is necessarily full of self-references. This is clear in philosophy and in psychology. But it reaches deeper in literature, because the essence of literature (and of all art) lies in the identification of ourselves with other human beings whose actions we are watching and judging as if they were our own. Here the self-reference is so integral that we cannot construct any of the provisional systems with which mathematics and science make do for a time, and which they then mend when the need arises.

In literature, there is no provisional description that can take the place of the work itself. We cannot replace it, as in science, by an axiomatic system which will do until it turns out to fall short and has to be enlarged. The references in literature by the writer to himself and others, and by the reader to himself in what he reads, penetrate the work through and through; and there is no way of getting round Gödel's theorems and Tarski's theorem and the others by any step-by-step procedure. In this respect, science and literature are different.

Neither science nor literature ever gives a complete account of nature or of life. In both of them, the progress from the present account to the next account is made by the exploration of the ambiguities in the language that we use at this moment. In science, these ambiguities are resolved for the time being, and a system without ambiguity is built up provisionally, until it is shown to fall short. This is why the results of science at any given moment can be presented on an axiomatic and deductive machine, although nature as a whole can never be so presented because no such machine can be complete. Whatever kind of machine nature is, it is different from this.

But in literature, the ambiguities cannot be resolved even for the time being, and

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no provisional system of axioms can be set up to describe the human situation as the writer and the reader seek to see it together. Here the brain cannot act as a logical machine even for the time being: by which I mean, that it cannot take in the information, sort out its ambiguities, and turn it into unambiguous instructions. That is not what a work of art does to us, and we cannot derive such instructions from it. I will quote at the last the passage from *The Identity of Man* of which, as I promised at the beginning, this essay is a detailed exposition. It states for the machinery of the brain the same limitations that I have exhibited tonight in its account of the machinery of nature.

> I am asserting that there is a mode of knowledge which cannot be spelled out formally to direct a machine. It may be asked, Any machine? If this is a question in the present, then the answer is Yes. For example, we know (from the work of Kurt Gödel and A. M. Turing) that no machine that uses strict logic can examine its own instructions and prove them consistent. But if it is a question about the measureless future, then it cannot be answered. A machine is not a natural object; it is a human artifact which mimics and exploits our own understanding of nature; and we cannot foresee how radically we may come to change that understanding. We cannot foresee and we cannot conceive all possible machines—if indeed the word *all* has a meaning in this sentence. All that we can say, and all that I can assert, is that we cannot now conceive any kind of law or machine which could formalize the total modes of human knowledge.

There is however one respect in which my exposition now goes radically beyond this passage, not merely in detail but in substance. That is in tracing the common quality of imagination in science and in literature to the logic of self-reference; and in showing that, within this common quality, the difference of mode between science and literature reflects the different extent to which self-reference enters their languages.

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On Cybernetics and the Human Brain

WALTER A. ROSENBLITH

Man's cultural achievements are largely products of his brain, a biological structure as complex as it is poorly understood. Throughout evolution increasingly powerful nervous systems have permitted the more highly developed species to adapt successfully to relatively stable natural environments. At the present time, at least in the so-called advanced societies, this natural environment is rapidly changing into one that is predominantly man-made. If man is to continue to adapt successfully, he can no longer afford to remain ignorant of the workings and the potentialities of his brain.

Men have certainly tried to gain such understanding. In the Western world, medicine—including pathology, neurology, neurosurgery, and psychiatry—has attempted to give a reasonable account of the most important malfunctions of the brain. Anatomists, physiologists, and more recently biochemists have tried to describe the brain's organization in considerable structural and even chemical detail. Still other disciplines have dealt with human brain functions in terms of sensory and perceptual capacities, in terms of memory, learning, and other types of *higher nervous* (or *mental*) activity. But all these attempts, no matter how successful and instructive, have led to only partial insights. There has emerged no compelling overall view, much less a well-founded theory of the brain's operation. At best, in different modern periods, suggestive metaphors were coined, each related to man's then current and most sophisticated technological achievement: the clock, the telephone, the computer. Each of these metaphors had its day of vogue and glory. When the next ultimate device appeared, specialists and laymen alike wondered how they could have been so naïve as to confuse the workings of as complicated a structure as the brain with that of a clock, for instance. These somewhat ephemeral metaphors, however, left the central question unanswered. What indeed is a reasonable way of describing man's brain and analyzing its *modus operandi*? What is a reasonable model of man's brain?

There exists a broad class of dissimilar devices known as machines. Hence to call something a machine or to compare something to a machine does not yield a great deal of insight into its makeup and function. The simple machines of mechanics (levers, pulleys, *et cetera*) are devices "by which the amount or direction of a force is changed for the sake of gaining some particular end, such as lifting a large weight." The complex machines of the first industrial revolution concerned with forces, motion, and energy are in principle decomposable into elementary simple machines. But this rather narrow technical meaning of the term *machine* acquires new shadings when the machinelike nature of bodily mechanisms is dealt with. According to the relevant part of the dictionary definition, "A person (or organization) acts like a machine in responding automatically and without intelligence or feeling as though responding mechanically to activating stimuli." The dictionary refers also to "the lower animals as mere machines without

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sense or sensibility." Without taking this set of definitions too seriously, we can see how deeply anchored views derived from Descartes have become in the absence of an up-to-date and comprehensible model of living organisms and, in particular, human brains.

Descartes's views on this subject were surprisingly subtle. He recognized that the concept of a machine carried with it the possibility of constructing a device *ab initio* from specifiable components according to a definite blueprint. Once such a device is built, its performance can be compared with the performance of the biological system whose function it tries to imitate or simulate. Such comparisons are relatively simple in the presence of a clearly defined and easily measurable function, that is, a machine with a special purpose. The more multipurpose the organisms or machines are, however, the more difficult it becomes to establish the criteria for these comparisons. Descartes was much concerned with how such comparisons could be carried out. Given machines or automata capable of simulating faithfully various human actions and even man's appearance, he formulated "two very certain tests" that would distinguish man from brute or more precisely identify those aspects of man's nature that could not be reduced to that of an automaton. The tests relate to (1) the creative use of language and (2) man's enormously varied repertory of actions. It is tempting to contrast Descartes's tests with the research goals of today's students of artificial intelligence: "to construct computer programs which exhibit behavior that we call 'intelligent behavior' when we observe it in human beings." According to Descartes, the human species has certain specific capacities that distinguish it from automata and other biological species and enable it to manipulate a great variety of symbols in the absence of special trigger stimuli. It is thus overall cognitive organization rather than possession of special vocal organs or level of I.Q. that accounts for the use of language in the communication of ideas and for man's ability to cope with many eventualities. As Descartes puts it, "It is morally impossible that there should be sufficient diversity in any machine to allow it to act in all events in life in the same way as our reason causes us to act."

Cartesian views are often oversimplified to such an extent that there may be a tendency to overlook or distort the complex of still perplexing issues he raised. Is there an unbridgeable, qualitative gap between machines and man? Man functions admittedly in part like a machine, but his uniqueness relates presumably to properties that no machine—no matter what its size—can exhibit. At this point one is led to the views of the materialistic philosopher-physician, J. O. de la Mettrie*; to him, man is simply the most intricate of all animal machines, and human nature can be better understood by precisely comparing the structure of man and of animals.

The nineteenth and the beginning of the twentieth century saw much concern with mechanisms that underlie reflex action. A mechanistic physiology attempted to provide correlative physicochemical evidence, trying to account for phenomena ranging from neuronal irritability to associative memory. In these researches models of a specific machine were hardly put to use, but the father of Russian physiology, Sechenov (who tried to establish in his *Reflexes of the Brain,* 1863, the physiological basis of psychological processes) wrote that ". . . the idea of the machine nature of the brain is a godsend to every naturalist." Pavlov and others referred to "machine-like, inevitable reactions," but this expression seems to have remained a metaphor without *direct* experimental or theoretical consequences. In these writings the term machine signifies in its generality mainly a commitment to some type of "objective"

* In his fascinating essay "L'homme machine" (1748), he tries to marshal both philosophical and observational evidence in favor of such theses as the following: 1. ". . . man is a machine, and . . . in the whole universe there is but a single substance differently modified"; 2. "I believe that thought is so little incompatible with organized matter, that it seems to be one of its properties on a par with electricity, the faculty of motion, impenetrability, extension, etc."; 3. ". . . the brain has its muscles for thinking, as the legs have muscles for walking."

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measurement. This attitude is not too surprising since there was no model of a machine whose functioning was particularly relevant to brain function.

When it became possible to communicate at a distance, the signals of telegraphy, telephony, and broadcasting posed a set of new technical problems to which the conservation laws of physics did not furnish much of an answer. Students of telecommunications became involved in the description and analysis (or even cryptanalysis) of messages, in their structure, their informational content, their resistance to contamination by adventitious noise. They needed to be able to describe the message-carrying capacity of a communication channel, they needed to know how reliably they would be able to control—via appropriate signals—the behavior of faraway power stations, of antiaircraft guns, *et cetera*. As these communication networks became more elaborate, men found themselves increasingly coupled to terminal devices such as telephones and teletype machines, at which messages were either received or sent.

Man first learned how to use tools and language; later on, he learned how to use machines to increase the power of his muscle with the aid of almost trivial control activities. Now it became obvious that he would be able to extend the scope of operations of his brain. He was able to control and correct in very subtle ways the behavior of complex mechanical devices on the basis of the information fed back to him via the communication channels. The new combination of man and machine seemed to hold the promise of becoming an organic entity, thus constituting a step in the now bio-cultural evolutionary process. To bring such a development about demanded new knowledge about man and his brain, knowledge that would make man's interaction with his machines more than just compatible or efficient. It was to this task of the human use of human beings *and* machines that Norbert Wiener dedicated himself after the publication of *Cybernetics* (1948), three centuries after Descartes.

In the mid-1930's there was formed in Cambridge on the Charles a circle of scientists led by the mathematician Norbert Wiener and the physiologist Arturo Rosenblueth. The latter was an associate—at the Harvard Medical School—of Walter B. Cannon, who is perhaps best known for his work on homeostasis, that is, the error-correcting regulation of the internal environment whose stabilizing influence represents "the wisdom of the body." Norbert Wiener's early education had been in philosophy and mathematics. As a mathematician he had become interested in the analysis of irregularities wherever they are found in nature; such irregularities characterize systems that have many more or less independently varying elements. At the Massachusetts Institute of Technology he worked intimately with colleagues in communications engineering and reflected and speculated on some of the pioneering work on modern computing machines then conducted under the direction of Vannevar Bush. The discussion group conducted monthly meetings on scientific method with particular emphasis upon those areas in science that constituted a no-man's-land between several established fields. In these meetings Wiener succeeded in becoming sufficiently familiar with empirical findings from the fields discussed to enable him to subject some of them to the mathematical techniques he had developed.

During this same period other scientists were concerned with the study of how complex networks made up of very simple elements such as switches or relays might behave—a switch being a device with only two possible states, open or closed. Some treated these problems as problems in electrical circuits, others as problems in logic, and still others as problems in nervous activity because a neuron's activity was presumably an all-or-none process and the neuron therefore another two-state device. These largely theoretical explorations led to some exciting results. It became clear that assemblies made up of a finite number of switches or hypothetical neurons would be able to carry out intricate computations. (Here the word "computation" needs to be taken in a broad sense: it refers not only to

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numerical calculations but to all those logical operations that such a network can perform.) A computing machine of this type represented a new model for the brain: it was a device capable of symbol manipulation, of, for instance, detecting and recognizing abstract features in a physical environment.

In the middle of World War II there came from the Cambridge group a highly influential paper on the role of purpose in the study and classification of various kinds of behavior. Its authors—Rosenblueth, Wiener and Robert P. Bigelow—contrasted such machines as roulette wheels and clocks, which do not have specific final goals, to machines like target-seeking torpedoes. They subdivided purposeful active behavior into two classes, depending on whether feedback was present or not. When there is feedback, the behavior (called "teleological") is controlled by the margin of error between where the object stands at a given time and its goal. This negative type of feedback prevents objects and organisms from overshooting their goals. All purposeful behavior, which includes voluntary activity, may be considered to require negative feedback to direct it toward its goal.

The authors also state that ". . . uniform behavioristic analysis is applicable to both machines and living organisms, regardless of the complexity of the behaviors." Although there is considerable overlap between the realms of behavior of organisms and machines, there are examples of behavior that are found exclusively in one or the other group. Whether research methods for these two realms can always remain similar depends on whether there are one or several *qualitatively* distinct, unique characteristics present in one group but absent in the other. Rosenblueth and his colleagues hold that such qualitative differences have not appeared so far in any significant area of behavior. This view seems to have been shared by the many designers of artificial animals—"bugs," "tortoises," "homeostats"—that have been built out of hardware parts to illustrate goal-seeking behavior.

Thus in the mid-1940's the stage was set for the emergence of a fairly cohesive complex of ideas that was to become known as "Cybernetics." The actual cauldron from which cybernetics emerged was a series of conferences in Princeton, sponsored by the Macy Foundation, and attended by mathematicians, communications, computer and control engineers, philosophers, and representatives from the various fields of study of the nervous system and social phenomena. The transactions of the later conferences have been published almost verbatim and offer fascinating insights into the personalities of the many colorful participants and, more importantly, into the process of the hammering out of a set of ideas. Most of the participants had been involved in World War II, and the lesson that "machines can't fight alone" had been driven home to them. These war activities rarely corresponded to the lines of traditional academic departments but were instead multidisciplinary, like Macy conferences. The mood of these symposia was one of optimistic and searching reconsideration of many topics that in complexly organized structures relate to communication and control via feedback. To Wiener and his colleagues these key concepts were clearly the cement of the nervous system and of social organization.

They were less concerned with giving a systematic account of how a particular mathematical technique or model related to a set of specific experiments than with suggesting novel ways of looking at old and intractable problems.

Wiener's *Cybernetics, or Control and Communication in the Animal and the Machine* is no scientific treatise, but it remains to this day an imaginative inventory of certain mathematical and conceptual tools from communication and control engineering. The author outlines in addition those topics from the life and social sciences to which these tools may be relevant. Cybernetics can hardly be thought of as a unifying science; it stands in a way between the sciences and philosophy. It suggests certain possible strategies for attacking problems in systems characterized by "organized complexity." It is considerably more, however, than a set of analogies or a

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convenient language in which one can talk about problems that seem to have something in common. It is an *état d'esprit* that encourages one to analyze biological and social problems not merely by thinking of organisms as machines but by specifying that the most significant *modus operandi* of the brain is that of information-handling under appropriate feedback control.

The particular information-processing machine to which the brain has been compared for the last twenty years is the high-speed electronic digital computer. Computers were more often than not referred to as "electronic" or "giant" brains. Initially these computers were certainly large enough in physical size; vacuum tubes and other electrical parts took up considerably more space than the billions of neurons in a human brain. Depending on his philosophical orientation, the person who set out to compare computers and brains could choose to emphasize similarities or dissimilarities.

In the posthumously published Silliman Lectures, *The Computer and the Brain* (1958), the great mathematician and computer scientist, John von Neumann, dealt with most of the comparisons that had been made and outlined the difficulties standing in the way of an intellectually satisfying resolution. Many of the particular numerical comparisons he himself attempted are a bit outdated in 1966. (Computers evolve rapidly, a generation corresponding to approximately four years!) But von Neumann's general approach remains valid today, whether the emphasis is on physical characteristics and performance of the "componentry" or on organizational features.

We no longer hold the earlier widespread belief that the so-called all-or-none law from nerve impulses makes it legitimate to think of relays as adequate models for neurons. In addition, we have become increasingly impressed with the interactions that take place among neurons: in some instances a sequence of nerve impulses may reflect the activities of literally thousands of neurons in a finely graded manner. In a system whose numerous elements interact so strongly with each other, the functioning of the system is not necessarily best understood by proceeding on a neuron-by-neuron basis as if each had an independent personality. Nor is there any reason to fashion a brain model on the basis of a single type of facts (anatomy, chemistry, electrophysiology). Admittedly the brain's electrical activity represents in convenient form events in the nervous system whose duration ranges from a fraction of 1/1000 of a second to several seconds; events in the life of an organism that are either much longer or much shorter are not well represented, however, by electrical activity. While there is currently much interest in the phenomena of memory from the viewpoint of molecular biology, it is not yet possible to contrast the componentry of natural and computer memory with respect to such particulars as number of storable items or access time to any particular item.

These very sketchy examples indicate how little specific progress can be expected from gross and overall analogizing. Detailed comparisons of the organization of computer systems and brains would prove equally frustrating and inconclusive. We might be able to identify successfully input and output devices in both. But we would have considerably more difficulty in formally identifying actual neural structures whose primary function is to deal with symbols, or to exercise control over other units, or to act as memory storage devices. And when we ask what type of information processing is genetically "wired in" and what is there potentially that has to be brought out by programmed interaction with environment, the situation is even more difficult.

What conclusions are we to draw from this state of affairs? That the computer is just another, not very appropriate, metaphor? Not quite! Even though detailed structural or functional comparisons may be tantalizing misfits, they have been responsible for many new and penetrating theoretical and experimental questions. Most of these relate to the handling of a commodity that is being called information, even though the formulations of information theory do not directly apply. In the

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handling of purely abstract or symbolic tasks, where we are as yet unable to point to any specific chain of relevant events in the brain, computer programs are the best systematic descriptions of the way in which men solve such problems; beyond this, these programs contribute significantly to an emerging cognitive technology.

But this is not all. Computers have become indispensable tools in the study of man's brain. They assist in detecting significant patterns of neuronal activity, and they permit us to simulate the possible modes of behavior of networks made up of quite realistic neuron-like elements. These few tasks can do no more than illustrate the generality of computers as logical instruments. No matter how important the clock, the telephone, and all the technological inventions that have enlarged man's sensory capacities, computers represent an effect of a different magnitude: man's ability to handle symbols promises to be many times magnified. The enormous development of man's cortex—both in size and richness of potential organization—is commonly considered the most significant aspect of the evolutionary jump man represents. By coupling the capacities of man's brain with the capabilities of computers in a manner that will make them supplement each other, we may achieve a significant jump in the individual's and society's ability to deal with problems that are now too complex to be handled by the unaided brain.

In our present state of ignorance with regard to the ultimate potentialities of both computers and brains, to ask whether computers are good models for human brains and whether man's uniqueness is a matter of quantity rather than quality, is hardly to ask the right questions. Instead we must ask ourselves how we can make wise use of the enormously enhanced logical capability that lies ahead and how we can achieve a wise division of labor between the bio-logical and the purely logical.

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Machines and Vitalists

Reflections on the Ideology of Cybernetics

ROBERT McCLINTOCK

"In the course of their search for the origin of things, investigators always thought that they found something which would be of the highest importance for . . . action and judgment: yea, . . . they even invariably postulated that the salvation of mankind depended upon *insight into the origin of things*. . . . On the other hand, the more we examine into origins, the less do they concern our interests." When Nietzsche wrote these words, men were flushed with the expectation that insight into the origin of species would enhance their judgment and valuations. Experience has proved that Nietzsche was correct, for the comprehension of human origins did not lessen the fallibility of man's decisions and deeds. The theory of natural selection did not give a formula for human choice; and the conviction that the fittest survived, a variation of the old sophistry that might makes right, did not make man sublime. Darwinism has passed; but the mystique of origins remains: some would equate reason with idealizations of economic interest, others would transform intellect into sublimations of sexual drives, and an increasing few would reduce mind to ingenious circuits of negative feedback. Can we expect this growing insight of cybernetics into the sources of thought to improve human valuation and judgment?

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Certain cyberneticians have been suggesting that their understanding of communication and control clarifies perennial confusions that cloud the human judgment. I do not refer to their having changed the background against which valuations and judgments are made. The artifacts of cybernetics are increasingly useful in the organization man's "decision-making process." My concern is different; besides the technical innovations, there is a conviction among cyberneticians and information theorists that their work will provide a better standard for the evaluation of human thought. By knowing how brains think, we can precisely appraise the quality of what they think. From the origin of thought, its destiny will be revealed.

Hints of this hope abound in the literature of cybernetics and information theory. The very name "cybernetics," coined from the Greek word for "steersman," portends its philosophical pretensions. For instance, one of the leading theorists in the field, W. Ross Ashby, was not content to have the word denote a group of technical problems: he made it connote normative potentials when he called his science "the art of steersmanship." Then he converted steersmanship into statesmanship by concluding that to those interested in the problems of man cybernetics "offers the hope of providing the essential methods by which to attack the ills—psychological, social, economic—which at present are defeating us by their intrinsic complexity." I have been told that one historian has already used these cybernetic methods to analyze the political machine of Boss Tweed. With more dramatic eclat, Warren S. McCulloch, a neurologist with M.I.T.'s Research Laboratory of Electronics, con-

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tended that a robot of only six relays could contradict Plato. He went on to give the cybernetic version of might makes right: "Sin, in its widest sense, is but to miss a mark." Ashby and McCulloch should, however, defer to Norbert Wiener as the most persuasive proponent of "the general ideology of cybernetics."

Sociology, anthropology, economics, epistemology and the philosophy of science were all to be brought under the sway of cybernetics, Wiener wrote in his autobiography. Besides creating this constellation of inquiry, he found that through his studies of communication and control he was "able to add something positive to the pessimism of Kierkegaard and . . . the existentialists." Taking another tack in *The Human Use of Human Beings,* Wiener investigated the relevance of cybernetics for society and used the principles of his science as the basis for sensible policy proposals concerning governmental secrecy. Finally his ideology of cybernetics seems to be winning some favor with the popular tastemakers, for his *God and Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion* received the National Book Award for 1964. In it Wiener's announced intentions were significant.

> I wish to take certain situations which have been discussed in religious books, and have a religious aspect, but possess a close analogy to other situations which belong to science, and in particular to the new science of cybernetics, the science of communication and control, whether in machines or in living organisms. I propose to use the limited analogies of cybernetic situations to cast a little light on the religious situations.

The hope was there: insight into the origins of communication and control may improve our moral sensibility.

These ideological aspirations are based on an attempt to develop a metaphysics of cybernetics in which it is argued that theories of communication and control will establish criteria for a materialistic conception of meaning and purpose. Cyberneticians find the materialistic basis of purpose in the phenomena of feedback. These are most familiar in the household thermostat that signals a furnace to start when the room temperature drops below the desired level and to stop when the temperature climbs above it. To the behaviorist, the thermostat acts with the purpose of keeping a room at the temperature one deems comfortable; to the cybernetician, all purposes are potentially analyzable into material feedback mechanisms similar to the thermostat.

An argument is not lacking for this belief. Norbert Wiener gave the following general description of feedback:

> When we desire a motion to follow a given pattern the difference between this pattern and the actually performed motion is used as a new input to cause the part regulated to move in such a way as to bring its motion closer to that given by the pattern.

He and others have shown that feedbacks of this kind can produce a variety of purposive behavior. The power to change a stimulus in the light of the response in a way that makes the response approximate a predetermined norm can be built into electronic circuitry, and by means of this circuitry automata have been built that behave purposively. Little motorized robots can be made to seek light or hide from it, to cuddle up to warmth, or to come wagging their tails whene'er they hear their master's voice. Several cyberneticians have argued cogently that the source of human purpose is in the neuronic feedback circuits of our nervous system; eventually, the material basis of these circuits will be understood and fully explained. Then, both simple mechanical performances and complex human aspirations will have been shown to result from a materialistic system that alters acts as they are performed in order to make them conform to a pattern. Consequently, the old inability of mechanistic materialism to explain the phenomena of purpose seems nearly overcome.

In like manner, the materialistic basis of meaning is found in electronic circuitry. The tendency of information theory, an extension of linguistic analysis, is to make meaning the equivalent of effective communication, or the reception by B of that which A sent. In both information theory and linguistic analysis the fundamental

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question is what can cause something to be true and to have meaning. For instance, Ogden and Richards said that their *Meaning of Meaning* was an attempt to account for thinking "in purely causal terms." The results of information theory have arisen from the mathematical determination of what coding procedures will most probably cause B to receive that which A sent through an imperfect communications system. Theorists hope that by studying how information about reality can be coded and transmitted via various systems of communication and control they will discover standards that will distinguish sense from nonsense. Meaning will become the equivalent of that which can be encoded and programmed through electronic systems. Hence, like purpose, meaning will be founded on electronic and neuronic circuitry. In both ways, the metaphysics of cybernetics suggests a mechanistic materialism.

Cyberneticians have been quick to point out one of the implications of this materialism: it contradicts the arguments for vitalism, or the belief that in explanations of life, biologists must use more than mechanistic assertions about physicochemical causality, and that a vital principle pertinent only to living things should be introduced into science. As Wladyslaw Sluckin, a psychologist concerned with cybernetics, has indicated, the vitalists' bastion was traditionally the problem of purpose, which suddenly yielded to the cyberneticians' physicochemical explanation. Armed with their mechanistic conception of purpose, cyberneticians have been outspoken critics of vitalism. Norbert Wiener called it a "question-begging epithet," which was, for a man of his temper, a question-closing epitaph. Elsewhere, he ironically accepted a vitalistic, Bergsonian conception of time, but only to add that for vitalism "this victory is a complete defeat, for from every point of view which has the slightest relation to morality or religion, the new mechanics is fully as mechanistic as the old."

Vitalism has its defenders. Edmund W. Sinnott, Rainer Schubert-Soldern and Erwin Chargaff, all eminent biologists, have pointed out that the expected physicochemical explanation of the cell has definitely not yet been made, and Schubert-Soldern has raised epistemological doubts whether a biochemical explanation of the cell, even if attained, can be accepted as a complete explanation of living matter. These arguments, significant as they are, only defend vitalism from being overrun by a materialistic biochemistry, but they do not take up the cybernetic critique of vitalistic purposes. The materialism of cybernetics, however, should not be allowed to win its point by default. Norbert Wiener was a historian of only his own ideas, and his idea of vitalism was rather narrow, being confined to the philosophy of Henri Bergson. Perhaps, if he had a fuller knowledge of the men with whom Bergson shared the name of vitalist, he might have been more circumspect in his assertions about mechanism and vitalism.

For those who do not give it close attention, history repeats itself. For instance, the cyberneticians' discovery that purpose results from feedback circuits repeated discoveries made earlier in this century by Jacob von Uexküll, a German vitalist. Uexküll was an unique figure in the history of biology. Although along with Bergson and Hans Driesch he was a major participant in the early twentieth-century renaissance of vitalism, Uexküll, himself, had few predecessors and he left few followers. In both research and theory he was highly original, which is not necessarily a happy trait in a natural scientist. His peers, who were stimulated by Darwin to study the genesis and development of life, did not understand Uexküll well because he had departed too sharply from their dominant interests. Whereas most mechanists and vitalists were propounding their expectations about the future prospects for contending theories of development, Uexküll simply observed that there was more to life than its genesis and that in explaining the living of life a nonmechanistic theory of function was indispensable. He based this theory of function on a vitalistic conception of feedback.

According to Uexküll, the task of biology

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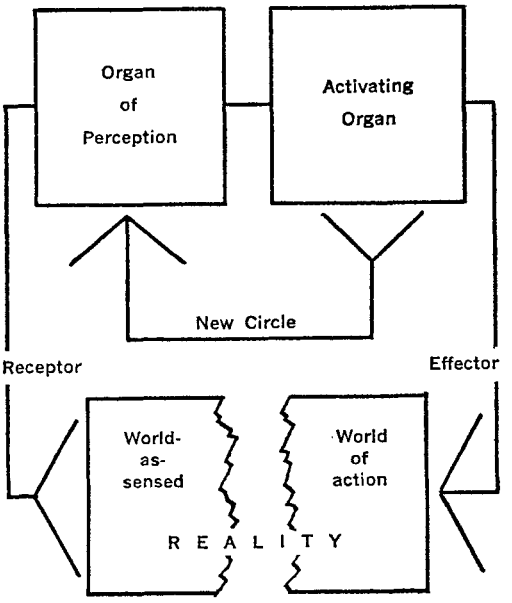
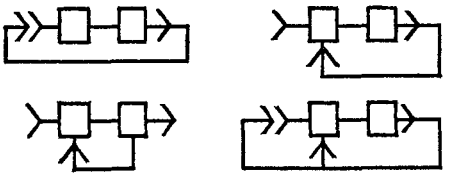
was twofold: to explain how a living system was generated, and to describe how various completed systems functioned. In his major study, *Theoretical Biology,* he arrived at a conception of feedback, or as he called it "the function-circle," by investigating this second problem of biology. Uexküll asserted that scientists who tried to explain the function of organisms as a process of physicochemical causality were indulging in anthropomorphic speculations. To be sure, other creatures subsisted in the world known by physics and chemistry; but they conducted their lives in a world of their own that included only those things that they could in some way perceive and act upon. The benevolent biologist had to make something of a phenomenological reduction on the part of the mute creature he studied and carefully catalog the things that entered into its sphere of activity, for these things were the functional facts that concerned the organism. Theories of physicochemical causality were insensitive to functional facts, which could be comprehended only by using the animal's vital pattern as a standard.

From empirical studies of the vital worlds inhabited by various animals, Uexküll abstracted a conceptual model of purposive behavior, the function-circle. Like a cybernetic feedback system, which has two halves, one for input and the other for output, Uexküll's function-circle had one part for perception and another for action. In the first half, a "world-as-sensed" was delimited by the capacities of an animal's sensory receptors, such as eyes or feelers, and by its organ of perception, such as the neural system that translated the stimulations received by the eye into a perceived vision of a thing. In the same way the capacities of the neural activating organ and the effectors—arms, claws or a digestive tract—defined an animal's world of action. By themselves these two halves of the function-circle amount to a simple input-output system with no feedback; but Uexküll observed that the function-circle was complicated by a "new circle," which allowed animals to act with more flexibility than a fixed response to a particular stimulus. By means of a new circle an animal could transform a preliminary response into the stimulus for a different, selective response. New circles allowed for highly selective activity in the world of action and for sharp concentration on specific features of the world-as-sensed. Uexküll diagrammed the whole system in a way similar to a cybernetic model:



There were different kinds of new circles depending on whether they began from an activating organ or an effector and ended at a receptor or an organ of perception. With an intuition similar to the cyberneticians, Uexküll called the new circles "steering mechanisms," and he gave them schematic signs that are similar to sketch diagrams of various feedback circuits used in cybernetics:



Different types of selective activity depended on the use of different steering mechanisms.

A complete function-circle, with all the relevant new circles, laid out the "plan" of

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an animal's life; the plan described the limits within which the creature could perceive and act. Things within these limits took part in the creature's vital drama; things outside them were elements in the biologist's world that did not exist as far as the animal was itself concerned. To comprehend a creature as a living being one had to study its function-circle to see what its vital potential was; then one could estimate the functional significance of a particular event by observing how the occurrence contributed to the animal's success or failure in fulfilling its life plan.

Hence, more than twenty years before the cyberneticians drew the connection between the principle of feedback and purposive behavior, Uexküll derived the principle from his study of vital behavior and found that it was the basis of selective and purposive activity. Thus, the same principle is at the heart of Wiener's mechanistic cybernetics and of Uexküll's vitalistic biology. This raises several interesting problems, not the least of which is the possibility that mechanistic and vitalistic conceptions may not be mutually exclusive.

Cyberneticians claim that their technology invalidates vitalism. Most vitalistic theories introduced a nonphysical something—an *élan vital,* an entelechy, or an "impulse"—to direct the process of development. Without it, the phenomena of self-repair, self-reproduction and self-improvement would be incomprehensible. The cyberneticians' feat has been to build machines capable of repairing themselves, reproducing themselves, and improving themselves, which, they claim, proves that the vital something is not necessary to explain these phenomena among the fleshly automatons that were once called life. As far as it goes this reasoning is cogent, and it even upsets Uexküll's vitalism insofar as it was a theory of development. But almost in anticipation, it would seem, Uexküll divided his vitalism into a rule of genesis and a rule of function, devoting his important work to the latter. Rather than being upset by cybernetics, the latter part of Uexküll's vitalism anticipated it and is confirmed by it.

In this case the vitalistic and mechanistic theories are not mutually exclusive; on the contrary, Uexküll's function-circle neatly complements cybernetics by filling in some dangerous gaps in the cybernetic system. In essence, the rule of function warns cyberneticians against the mystique of origins and their "general ideology." It shows that, contrary to Wiener's belief, the new vitalism is not mechanistic as far as morality is concerned.

Information theory tells the cyberneticians how to combine electronic artifacts in ways that will create feedback systems suitable for various tasks. Information theory is quantitative and it is useful in the development of systems for communication and control. There is a tendency, however, to use the same theory to analyze how these systems function; and this second use leads to ambiguities, for it applies a quantitative conception, which describes only the production and consumption, not the content, of messages, to qualitative situations that depend on the content, not the construction, of the messages. Unfortunately, not even computers can add apples to oranges. To anticipate the argument, then: in the light of Uexküll's rule of function, information theory should have only one duty, to enter into the design of cybernetic systems; the function-circle, replete with its teleology, is the proper way to describe the functioning of brains—be they neuronic or electronic.

As a quantitative conception, information theory is based on the idea of a "message," which Norbert Wiener defined as "a discrete or continuous sequence of measurable events distributed in time." A message is measurable because it is a sequence of information units, each of which is "a simple decision between equally probable alternatives." Consequently, one can measure the magnitude of the message by counting the number of information units it contains. Information theorists prefer a binary system as the most efficient basis for the information unit; hence, the binary unit, or "bit," is a decision between only two alternatives: yes-no, plus-minus, in-out, 1-0, to be or not to be. The important point is that for the information theorist,

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unlike Hamlet, it is of no interest which of the two alternatives is taken. Like the "Message Units" for which we monthly pay A.T.&T., information units are each of equal value, it matters not whether we use one to summon the doctor or the wrong number as long as we get an "answer." Therefore, to begin with, information is a quantity measured by counting decisions between alternatives; contrary to the layman's intuition, the content of the alternatives is nugatory.

Quantitative information is a useful conception, but the layman's intuition that information must be informative overpowers even the expert theorist. Norbert Wiener wrote:

> Information is a name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it. The process of receiving and of using information is the process of our adjusting to the contingencies of the outer environment, and of living effectively within that environment.

Wiener's second conception of information is not the same as the first. Unlike the quantitative theory, in the second case each bit of information is not of equal value. In adapting to the outer world it makes a great difference whether we summon with a message unit the doctor or the wrong number. In the end, information, which strictly was a quantity, becomes a quality judged by assessing the alternatives between which we must decide.

Despite this ambiguity Wiener was correct in his intuition that feedback was connected not only with the quantitative kind of information; he was correct in quipping that "information is information, not matter or energy." Nevertheless, the quantitative conception, which merely postulates a pulse of electrical energy passing through a material switching circuit, cannot explain the informativeness of information because the content of the message was abstracted from it in order to give it mathematical precision. Instead, the vital plan marked off by Uexküll's function-circle gives a standard with which the informativeness of any bit of information can be estimated. The very language that Wiener used in his second, qualitative definition of information leads straight to Uexküll, for the "outer world" and "outer environment" are the same as the vitalist's world-as-sensed and world of action. In essence, Uexküll's function-circle was a means of specifying what was, and what was not, informative to different beings. Consequently, Uexküll's conception complements cybernetics by using the principle that it shares with the newer science to explain the qualitative phenomena of information that the quantitative theory of cybernetics cannot avoid and cannot explain.

Nevertheless, cyberneticians are a notoriously self-confident group, and they may reply that Wiener made a slip in using a qualitative conception of information and that they would rather stick to quantities than admit the sensibility of any metaphysical concept of "informativeness." To preclude such a Thrasymachian response it is wise to follow the advice of Ben Franklin, whose Poor Richard said: "Would you persuade, speak of Interest, not of Reason." Philosophers such as Ernest Nagel have condemned vitalism for scientific infertility —a venal sin according to those who account for truth by its cash value. But Uexküll's vitalism has a cash value for cyberneticians in both an economic and intellectual sense. A distinction between quantitative information and functional informativeness will help cyberneticians design better machines and it will reduce the false expectations that both cyberneticians and the public have about long-outstanding intellectual problems.

In the field of computer design the most severe lack of knowledge is not how to design and build bigger and faster machines, but how to make them function, how to integrate them into the human world, and how to make them do what we want them to do. Norbert Wiener's later writings harped upon the dangers we risk by building machines to perform functions that we do not adequately understand. The dangers are real because our ability to design machines is more fully developed than is our ability to understand the purposes to which they might be put; and we could

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end by putting electronic machines to uses we would not want to put them if we really understood what the uses were. Less awesomely, this problem means that given an adequately specified purpose, computer engineers can probably design a machine to meet it; but many purposes cannot be adequately specified to the engineer.

By using Uexküll's function-circle, the elements of a purpose or function can be investigated. In *Theoretical Biology* he showed that for any particular mode of being there is a definite world-as-sensed and world of action. From this data one could work back and specify the capacities of the receptors and effectors that would correlate with the desired world-as-sensed and world of action. By knowing the capacities of the receptors and effectors that would be needed for a particular purpose, one could determine the capacities for the activating and perceiving organs that would be necessary to link the receptors and effectors together. For instance, in passing, Uexküll gave directions that would be sufficient for designing a machine that, like a bullfinch, could learn to pipe new tunes. And a hasty specification of the human function-circle suggests that confidence in the cybernetic technologists' ability to build any specifiable system may be premature and that *"l'homme machine"* is still a figment for the future. But this is not the place to put Uexküll's ideas to work analyzing the potential functions of cybernetic systems. Suffice it to observe that Uexküll's conception of the function-circle *may* increase our ability to analyze the operations of functionally complex systems of communication and control, and thus increase our ability to design more useful systems. It would be ironic if the pragmatists' animus against metaphysical constructions like "informativeness" would prevent them from testing this potential cash value.

More importantly, however, the cybernetician has a second, intellectual interest: to avoid talking nonsense. The realization that both quantitative information and functional informativeness pertain to any feedback system will prevent his falling into sophistry. For sophistry arises from the mystique of origins, the tendency to use cybernetic revelations of how we think to judge the quality of what we think. It is true that computers can be validly used as analogues to the human brain in order to explain how it processes bits of information. Consequently, there has been a useful exchange between cybernetics and psychopathology. But there is a tendency to overextend this analogy and to use the quantitative theory of information to pontificate upon its functional informativeness. This overextension results from the sophistical use of analogical reasoning. Let us take an example.

In his declamation, "Mysterium Iniquitatis," Warren S. McCulloch asserted several startling things about the power of robots. They can deduce "any conclusion that follows from a finite set of premises" or, like a Lockean slate, they can have "any general idea that can be induced from our sensations." Given the proper circuitry, robots can generate memories, general ideas, Spinozistic consciousness, and the idea of ideas. McCulloch continued, "these robots, even simple ones having but half a dozen relays, may, without inconsistency, show that circularity of preference, or of choice, called the value anomaly which—contra Plato—precludes a common measure of 'the good.' "

McCulloch found what observers of life have long known: the processes of thought are such that neither man nor machine will arrive at an eternal definition of the good. Those who have read their Plato with care know that he claimed no absolute knowledge of the good. But even if Plato had offered a universal standard, the circularity of preference in but half a dozen relays would qualify, rather than preclude, the common measure. Thus, a robot could endlessly scan the world and never find a point that fulfilled its geometrical definition of dimensionless location. That anomaly would not preclude the concept of point; it would make us qualify our idea by saying that the point is a fiction that has proved productive in geometry. In the same way, the value anomaly does not preclude a common measure of the good; it converts the idea into a useful fiction. Contra McCulloch and his robots—that is

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all Plato claimed; he investigated the function that the idea of a universal good might perform in the geometry of justice.

Ideas serve a function in human life and therefore what half a dozen relays generate is not an analogous equivalent to Plato's intellection. Psychopathology is not philosophy, just as quantitative information is not functional informativeness. In order to create a mechanical analogue to social and ethical philosophy, one would need to build a system that was functionally, not merely formally, equivalent to the philosophizing brain. That would be a large order. But let us imagine that McCulloch managed to populate a world such as earth with three billion or more machines, each as functionally complex, as easily destroyed, and as difficult to reproduce as man; let us further imagine that he divided these machines into various groups, which compete for the scarce resources of mechanical sustenance. Would these robots be so quick to preclude the idea of a common good?

Formal equivalents are not necessarily functional equivalents, and any argument about the significance of cybernetic formalism for human thought that does not take this fact into account is sophistic nonsense. With their background in logical positivism and its aversion to all nonsense, cyberneticians may then find it in their intellectual interest to heed the conception of functional informativeness; for Uexküll's function-circle avoids the reductionist errors to which the cybernetic idea of feedback is susceptible and it effectively illuminates the sense of conceptions such as Plato's common measure of the good.

By analyzing the human function-circle Uexküll showed that an ethical dilemma was a significant element of the human world. He observed that the function-circles of human beings and of human societies were interdependent, yet divergent. The human individual thrived in liberty, the human society necessitated subordination. If the human species was to continue its development, he contended, neither liberty nor subordination could become dominant and suppress or exclude the other. Therefore, the task of social and ethical philosophy was to reflect upon human experience in order to reconcile the contradictory characteristics of persons and societies in a way that would enable men to profit from both individual initiative and social organization. In the tradition of which Plato is a part the conflicting imperatives of the individual and the social have been reconciled by the conception of a community of individuals held together by common ideals. The quality of Plato's contribution to this tradition should be judged not on the basis of its cybernetic thinkableness, but on the basis of its value in relation to the human situation, which Uexküll's version of the art of steersmanship helps reveal. Plato has not been precluded during the past twenty-four centuries, because his aspiration to a common measure of the good has helped ensuing communities of individuals hold themselves together through common ideals. In this way, Uexküll's use of the feedback principle helps us understand the sense of moral speculation such as that of Plato.

Consequently, Norbert Wiener was only partly right: there is a new mechanics. But he was wrong in claiming that from the point of view of morality and religion it is as mechanistic as the old. In one direction, the feedback principle shows that thought can be produced mechanistically; and in the other, it indicates that the adequacy of a thought can only be judged in view of the needs, potentials and purposes of the system that did the thinking. Therefore, man is still man's measure, and "know thyself" continues to be the way to wisdom.

With the cyberneticians' economic and intellectual interest securely engaged, it is safe to appeal to reason. Epistemology provides an explanation for the surprising discovery that cybernetic materialism needs to be complemented by a biological vitalism and that the quantitative theory of information needs to be balanced by a conception of functional informativeness.

One of the reasons that Uexküll fared poorly with his peers was that he was an outspoken Kantian and they were not. Uexküll thought that science interpreted phenomena, not reality. "In Nature everything is certain; in science everything is

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problematical . . . . [Scientific theory] does not itself pertain to Nature, but is always something extraneous." Neither vitalism nor mechanism would tell us what life was in itself. Therefore, since absolute reality was beyond our ken, science had room for both mechanism and vitalism; they did not need to be mutually exclusive. Uexküll, himself, was not both a mechanist and a vitalist, but some of the distinctions he made opened the way to this dual view. Most important was his distinction between the rule of genesis and the rule of function; for it frees us to explain the development and production of things through physicochemical causalities and, at the same time, to interpret the operation and functioning of these things with a purposeful teleology.

Kant provided a basis for this distinction in his *Critique of Pure Reason*. He asserted that all phenomena were subject a priori to three rules, the principles of permanence, production and community. Here the principle of permanence may be disregarded because it pertains to both the rule of genesis and the rule of function. The principle of production is that "all alterations take place in conformity with the law of the connection of cause and effect." This principle governs the rule of genesis, and it suggests that an inquiry into how things came to be will be causal, which in our time has come to be the same as physicochemical. The principle of community is that "all substances, in so far as they can be perceived to coexist in space, are in thoroughgoing reciprocity." This principle governs the rule of function, which studies not how a system is produced, but how it works when it and all the things with which it interacts are coexisting. The principle suggests that interacting things should be conceived as wholes, or communities, in which each part has a place; and thus it leads to a purposive, teleological interpretation of the pertinent phenomena.

Hence, a Kantian might have predicted that from the phenomena of feedback two scientific systems would arise, one illuminating the law of causality and the other the law of reciprocity. Positivists should be impressed by this nice confirmation of Kant's analogies of experience. That causality and reciprocity are separate, but complementary, interpretations of the same thing generalizes the reasoning by means of which Nietzsche observed that the Darwinian insight into the origin of man would not solve man's problem of justly evaluating his own acts.

Finally, the distinction between a rule of genesis and a rule of function helps state the problem of the unity of our culture. The apparent dichotomy of the "two cultures" will not be overcome by endowing everyone with a stock of conversational tidbits about Dickens and DNA. Reestablishing the unity of intellect is, as my mentor Martin S. Dworkin teaches, a problem of reestablishing the primacy of philosophy over all its former parts. The particular achievements of inquiry have never been continuous, each with the other, and they have never been an essential part of that common sphere of discourse inhabited by educated men. Instead of cultivating the lordly banality of being at home in every group, masters of the arcane might again pay heed to philosophy, which aspires to state the conditions of thought in such a way that a desirous inquirer could relate his work to that of any other who shared his desire. Thus, the principle of production and the principle of community yield two methods that become one in the philosophic mind, for both methods pertain to all phenomena. For the man who is willing to embark upon a course of disciplined self-examination there is, in Jacques Barzun's phrase, only one mind of many modes. But in the absence of this disciplined inquiry certain scientists have become obsessed with finding laws of causality, and certain writers with comprehending the conditions of reciprocity. Both elevate their interest into the "one thing needful," and forget that production and community equally pertain to all endeavors. Remember that Pascal was writing about the philosophers when he observed:

> We do not display greatness by going to one extreme, but in touching both at once, and filling all the intervening space.
>
> Pensée 353

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A Computer for Everyman

HERBERT A. SIMON

After extensive firsthand observation—nearly two weeks of it—my wife and I agree that we now understand India, and intend to write a book about it. In the best tradition of travelers' tales, we shall record nothing but accurate, detailed descriptions of specific scenes and events that our eyes, ears and noses actually encountered. In only one respect will our book differ from the usual Odyssey: One of us will write the left-hand pages, subtitled "The Mysterious East," which will describe facts and events that are incomprehensible to the Western mind; the other will write the right-hand pages, subtitled "Everyman," which will demonstrate concretely the one-worldness of human nature.

Books and articles of social prophecy should probably be written in the same way. Without a comprehensive metric for averaging constancy in one set of institutions with change in others, it is easy, ignoring what is written on the right-hand pages, to foretell sweeping revolutions in human affairs, or ignoring what is written on the left, to find that nothing changes under the sun. Today it is fashionable to stress the left-hand pages—to emphasize change. In discussing the "computer revolution," or the "communication revolution," or whatever the current revolution is to be called, I shall be inclined, by way of redressing the balance, to exaggerate in the other direction—to show in what important respects tomorrow's megalopolis will resemble today's metropolis, and indeed, yesterday's Athenian polis.

Let me be explicit about the metrics of change I shall use. First, there are the technological metrics—the direct measures of change. To these we can often assign numbers of quite general significance: Installed horsepower per worker measures meaningfully the distance of the Athenian workshop from the modern factory. Thousands of multiplications per second, and numbers of symbols of storage capacity provide a common scale for abacus, clay tablet and electronic computer.

A second set of metrics of change is economic. Per capita real incomes, measured in roughly comparable bundles of goods and services, can be calculated for Athens and for Pittsburgh, and can reasonably be projected into the world two generations hence. At a cruder, but still meaningful, level the percentage of people who are engaged in agriculture measures an economy's overall productivity.

A third set of metrics is hedonic. It is no use to deny that such metrics exist, for we make commonsense use of them every day, and I intend, in my discussion, to stay at the level of common sense. For most purposes a simple ranking scheme will suffice. A society in which many people are hungry and sick will receive a lower hedonic score than one in which most are well and properly nourished. Among affluent societies the comparison is more difficult; it may be most reasonable to assign them all the same score—for reasons I shall mention later.

A fourth set of metrics is iconic. There are not only changes in man's world, there are also changes in man's picture of his world, in the system of concepts and ideas through which he interprets his experi-

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ences. Iconic changes are the most important of all, for they are changes in man himself. Man must also provide the measure for them: he estimates his distance from Pericles' Athens by judging how well he understands the men of Athens.

We must not be misled by the term "metric," which serves here as a synonym for "basis for assessing change," and commends itself by its brevity rather than its literal accuracy. Particularly in the hedonic and iconic dimensions, our "metrics" must be capable of describing qualitative as well as quantitative change. With this understanding we proceed to examine each dimension in turn.

Technology

Everyone now knows that electronic computers can add and multiply numbers very rapidly, and that they are very useful for performing such tasks in offices, factories, laboratories and universities. Even those persons who live in daily, intimate contact with computers are only beginning to learn what else computers can do. In particular, understanding computers requires overcoming two deeply rooted prejudices that are still prevalent. The first is the prejudice that computers have some special affinity for numbers, as distinguished from other forms of symbolized meanings. The second is the prejudice that computers intrinsically lack spontaneity—"They only do what you program them to do."

Most human communication takes place by transmitting, orally or visually, highly stylized patterns called phonemes or letters, respectively, arranged in nested sequences called words, phrases and sentences. In order to communicate, human beings must be able to produce strings of patterns, and to sort or discriminate among patterns that they hear or see. These abilities are necessary, although not sufficient, conditions for human communication.

Every computer possesses these same abilities for handling essentially arbitrary patterns. The patterns can as well resemble the shapes of letters as of numbers. Inside the computer are neither numbers nor letters in any ordinary sense, but only arrangements of electromagnetism. What these stand for in any instance depends entirely on what programs are stored in the computer. (The same is true, of course, of the human head. There are neither numbers nor words in it, only neurons.)

One way to test whether a human being understands the English language—or some part of it—is to open at random a copy of Hoyle's book of games and ask him to play the card game or board game described on that page. In the present state of the art, an appropriately programmed computer can pass this test, with the proviso that the text of Hoyle be edited a bit to simplify the grammatical constructions. (This capability has been demonstrated by a program written by Thomas Williams as a doctoral dissertation at Carnegie Tech.) The example, one of many, shows that computers are general symbol-manipulating, information-processing devices, quite as ready to handle nonnumerical as numerical language.

So much for numbers. What about spontaneity? We are sometimes tempted into confusing spontaneity—including those forms of spontaneity we call creative—with randomness. Of course, there is no difficulty in generating random numbers in a computer program, but somehow that does not seem to be the kind of spontaneity that interests us in humans. If spontaneity is randomness, why do Picasso's drawings consistently turn out so much better than mine?

A more likely hypothesis is that behavior appears spontaneous when its relation to the immediate stimulus situation is unobvious and complex. To explain spontaneity, we need not assume that behavior is uncaused, merely that its causes are multitudinous and that many of them come from the distant past via stored memories. A computer that is an empty box until we walk up to it with our program is unlikely to behave in a manner that appears spontaneous, unless the program is very large. In the latter case—a chess-playing program, for example—it will do just what we programmed it to do; but often, to our astonishment, we will only learn what we

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programmed it to do when it makes a move. Although the program has only sketchy memories to draw upon, the innumerable relations and interactions of pieces on the chess board provide the complexity that appears as spontaneity.

More and more, the computer to which we bring our programs is not an empty box. It already has stored in it many capabilities that go by the names of "assembly languages," "monitors," "subroutine libraries," "user-oriented languages" and "information files," and the like. The computer's behavior now is not simply a function of the program we provide; the program interacts with all of these stored memories. Such a system can behave spontaneously indeed—particularly if we do not know the detailed structure of the previously stored programs. It will certainly not behave in a fashion that appears "machine-like" to us. In the interest of parsimony it is worth conjecturing that nothing beyond this is involved in human spontaneity.

The only purpose in recounting these "Gee Whiz" achievements of computer technology is to warn against interpreting that technology against the background of beliefs that are no longer valid. Measured in terms of multiplications per second, or numbers of cubic feet required to store the contents of the Library of Congress, the technological revolution is impressive enough. Much more significant is the fact that computers can carry out many of the information-processing tasks that until recently were the monopoly of human beings.

Indeed, it has not been demonstrated that there exist such tasks that humans, but not computers, can do. Some of us think there are none. If we are right—and even if we are only moderately wrong—we must ask what implications such a fact will have for our economic, hedonic and iconic metrics.

Economics

Technology does not automatically entail economic consequences. For example, atomic generation of electric power has been technically feasible for almost two decades. Without government subsidies, it still is not economically advantageous in most places; and when it becomes so, it will have only a modest effect on the productivity of the economy.

Since my views on the economic consequences of automation are set forth at some length in my recently published book, *The Shape of Automation,* I will state the conclusions briefly here, but not defend them. These conclusions are shared by all professional economists today except a scanty handful. Hence, my confidence in them is bolstered by the overwhelming weight of informed authority that supports them.

Computers will contribute to the steadily increasing productivity of our economic system, but at rates of growth quite comparable to those experienced in the last century, so that average family real incomes will double approximately each generation. Arithmetic applied to the present average family income (about $7,000 in the United States) shows that this increase will produce neither glut nor satiation over the next several generations in this country—much less in Asia or Africa. Part of the increase in the United States will be consumed in the form of leisure, which people will find many ways of using.

The economy operating at these higher levels of productivity will experience no more difficulty in maintaining substantially full employment than it has during the past two decades. That is, the kinds of government economic policies now pursued will keep ninety-five percent or more of the labor force employed at steadily increasing real wage levels. At the same time, there will be problems of residual unemployment, not specifically related to automation, that will require attention and action.

The highly automated economy—that is, the economy with a high ratio of computers to human workers—will call for roughly the same spectrum of human skills as are now employed. As in the past, the skill requirements of the economy will adapt to the human skills available. More jobs in the future will call for college training because there will be more college-trained people to fill them. As any academi-

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cian who is honest with himself will admit, there are few kinds of jobs requiring training obtained in college. Anyone who can learn to drive an automobile (that is to say, almost any noninstitutionalized adult) will have employable skills.

If the chapter on technology of my travelogue was written mostly on the left-hand pages, stressing change, the economic chapter has appeared on the right-hand pages, stressing continuity with present and past. Economically, it would appear, the Communication Revolution is simply a continuation of the Industrial Revolution by other means. But if we take contemporary India or Periclean Athens as the base from which to measure economic change, rather than nineteenth-century America, we will not underrate the cumulative economic importance of either of these revolutions.

The productivity revolutions have opened the realistic prospect of a world in which the basic physical needs of all men (not only citizens) can be satisfied without shackling anyone in slavery or excessive toil. The population explosion—an unintended consequence of the revolutions—may push that prospect a little further into the distance, but is unlikely to delay it more than a few generations. To these developments, however, the computer contributes little that is qualitatively new; at most it increases a bit the rate of change.

Hedonics

In a world where food is scarce, common sense argues for a close tie between economics and hedonics. Once the pain of unsatisfied physiological demands has largely been relieved, matters become more complicated. We know very little of what makes people happy, once they are fed and warm. Apparently, people obtain happiness from some kinds of work (but not others), from some kinds of leisure (but not others), from some kinds of interaction with other human beings and some privacy, from some kinds of recognition, from some kinds of opportunities to make choices and exercise judgment (but not others), and so on.

Almost all human beings, however, possess a mechanism that simplifies hedonic measurement: in modern psychological language it is called a floating aspiration level, in Genesis it was called a serpent. Feelings of well-being depend on the relation between the actual and estimates of the attainable. Estimates of what is attainable are based, in turn, on experience. Hence life can never be so good that it does not generate thoughts of how it might be better, nor so bad that it could not be worse.

Whatever hedonic measure we use, therefore, we can expect to write most of our prophecy on the right-hand page. There is nothing about computers, or the other technological changes in communications, that is going to make man very much more satisfied or very much less satisfied with what he has—whatever that might be.

Terms like "Machine" and "Mechanized Civilization" are often used as epithets today. The myth of the happy savage survives all the empirical evidence that anthropology can bring to bear against it. Everything we know about man suggests that he can find pleasure as readily in an urban environment rich in complex machines, like computers, as on a nineteenth-century farm (hardly a "natural" environment), or in a forest ("natural" enough, but highly threatening). In hedonic potential, Megalopolis is no more and no less a natural environment for man than Athens or a peasant village.

Iconics

We reach the final question with the right-hand pages, so far, fuller than the left. Will it be different with iconics? If the Machine will not make Man unhappy, will it change Man into Nonman?

To what extent has changing technology altered man's manner of thinking about the world and about himself? I have suggested as a measure of the change the communication distance between Pericles and ourselves. In modern man, a tragedy of Aeschylus, Sophocles or Euripides can still "arouse pity and fear, and accomplish its catharsis of such emotions." Oedipus provides to Cocteau and Stravinski a viable text for a musical drama, and to Freud a

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deep insight into the springs of human action. If it be objected that Oedipus, while meaningful, means something different to me than it did to Pericles, I reply that my reasons for believing that Pericles and I understand each other are as good as my reasons for believing that you and I understand each other; or that I understand a Camus who expresses an existential despair that I do not feel.

It is the truth, if not the whole truth, that the focal events and the climactic emotions in my life and my neighbor's are almost identical with those in the lives of Pericles, his neighbors and his forebears. Homer would find all the materials for his third epic in this morning's newspaper: wars, floods, murders, shipwrecks, negotiations, births, deaths and marriages. Love, hate, curiosity, friendship, ambition, fun, pain were and are the substance of the human condition. Man is the significant part of man's environment; the nonhuman environment, whether the forest or sea designed by nature, or the farm or city by man, largely defines the rules of a particular game within which meaningful human interaction takes place.

Of course, if we take Aristotle instead of the poets as our model of the Greek mind, we arrive at a quite different measure of the communication distance that separates us from them. As far as physics, biology and mathematics are concerned, the gulf with the past has opened to limitless depth. It is not a question of whether Aristotle, Archimedes and Euclid are right or wrong. Their writings have simply become irrelevant except as data for the antiquarian or the historian of Western thought.

If we viewed science only as the foundation for our technology and our economy, we could perhaps pass the change off as unrelated to humane matters—as not touching the fundamental icons. But science is inextricably interwoven with cosmology, with theology, with epistemology, with ethics, politics and psychology, all of them crucial to exploration into the human condition. A cosmology cannot be taken seriously that is not consistent with modern mechanics and astronomy, nor an epistemology that is naïve in its understanding of operationalism, quantum uncertainty or the Gödel theorems. To understand Zeno's paradoxes, we do not study the classics, but Weierstrass and Cantor.

All of this is a familiar restatement of the Two Cultures argument; it predates the computer, and would be true if the computer had never been invented. But the computer lengthens the gulf that separates our icons from those of previous cultures all the way into the sciences of man. Man has held up a mirror to nature; now he will view himself in it.

Man's words, like the clippings of his hair and nails, are divorced parts of himself, not lightly to be put in the hands of his enemies, who might use them to gain power over him. A long time ago, however, man began to entrust some of his words and numbers to clay tablets and papyrus. With the invention of printing, five hundred years ago, he became almost willing to grant them a life of their own. By freeing and cheapening their reproductive process, printing caused a great explosion in the population of words. (The explosion has been heard almost everywhere except in the lecture halls of universities, where words are still reproduced, inaccurately, by handicraft processes at a very high cost.)

Printing, however, automated only a single symbol-manipulating process—copying. Pattern recognition, information retrieval, the whole range of processes that go under the name "thinking," were untouched. Printing, for all its practical consequence, gave man little insight into his own symbol-manipulating processes, and contributed almost nothing to the science of psychology.

The computer is a different matter. It is capable, as we have seen, of a very broad range of information processes—perhaps all the kinds that man can carry out. To design, manufacture and program computers man has had to acquire an understanding of information processing, and as a result, new knowledge about the processes of his mind.

The computer is bringing about its revolution in psychology in two different ways,

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one general, one specific. Neither development rests on any vulgar analogy between the computer as an electronic system and the brain as a physiological one. The anatomy of a computer is visibly different from the anatomy of a brain.

The general contribution of computers to psychology has already been suggested. Airplanes have taught us a great deal about the flight of birds, although the two systems function quite differently. Likewise, when one programs a computer to play chess—even if without intent to imitate the methods of human players—one inevitably learns much about what is required of *any* information-processing system that is to perform the task successfully. Thus we have learned that in complex problem environments a very modest ability to explore selectively compensates for an enormous disadvantage of speed of search. The race is to the slow, provided that they are also thoughtful and selective.

But computers are also making a more specific and farther reaching contribution to psychology. They are providing a language for stating psychological theories, and an effective means for generating testable implications of the theories so formulated. Progress in a science has always depended critically on the availability of formal languages that permit the fundamental principles to be stated in clear, parsimonious, operational terms. Almost as soon as the calculus provided such a language for classical physics, Newtonian mechanics emerged.

Computer-programming languages provide a formalism far more powerful than any previously available for formulating theories of human psychological processes. A computer program embodies an organized system of principles that predict (or govern, when actually transmitted to a computer as a set of instructions) the behavior of a complex system for processing information or manipulating symbols. Already there exist considerable bodies of theory, expressed in computer-programming languages, explaining how rote learning occurs, how people solve problems, and how they detect and encode temporal patterns.

Through these and other lines of inquiry—research, for example, on the physiology of the brain—man's understanding of himself as a processor of information is advancing rapidly. It is still unclear how far these advances will extend into the realms of motivation and emotion, but the latter phenomena also seem amenable to statement in information-processing terms. Man is drastically reformulating his picture of himself; his distance from Greece, and even from the early twentieth century will be very much increased as a result.

What consequences will follow from these changed icons are far from obvious to me. One likely consequence should be mentioned, however, for it bears directly on the Two Cultures problem.

In reality, there are not two cultures, but n cultures, where n is a large number. Each man shares with most of his fellows an area of common interests and concerns, and is separated from all but a few of his fellows by a multitude of special interests, skills, and bodies of knowledge. If it is obvious that scientists cannot communicate with humanists, except in the common area outside both their special professional skills, it is equally obvious that musicians cannot communicate with painters, nuclear physicists with physiologists, or eighteenth-century historians with fifteenth-century historians.

Literature has faced this problem of general relevance by concerning itself almost exclusively with the "private" lives of its characters; in most cases their professions could be drastically altered without much damage. (Melville is an interesting exception; here metaphor and allegory carry the burden of making the profession of whaling humanely relevant.)

The exclusion of professional activity—whether scientific, artistic, scholarly or craft—from the area of man's common concerns is anomalous; for most creative persons the profession is the core of life and value, the "common" area almost secondary. The humane, culturally defined, fails to include a great part of what is most significant for them. If we recognize that what is most significant for the creative physicist is not the body of physical theory

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and data, but *doing* physics, and what is most significant for the creative musician is not the body of musical literature, but *doing* music—performing, or composing or listening—then we can see a solution to the dilemma. Doing physics and doing music are creative processes that involve thought in a rich context of motivation, evaluation and emotion. As we learn more about human thinking, we are coming to see that these processes are essentially the same, whether in physics or in music, once they are abstracted from the particular materials on which they work. They are human processes that provide common ground for all professionals in the same way that the processes of loving, hating, eating and shivering provide common ground.

Understanding our processes of thinking and searching and seeking will lead us to discover that the skills, the values, the pleasures that we share with other men are not limited to the extraprofessional hours of our lives, but extend to the very core of our daily activity, however specialized and esoteric its content may appear. Our ability to communicate about these processes will lower the barriers that separate us, as professionals, so sharply from one another.

The specialization of the disciplines that has developed since Gutenberg is a regrettable consequence of the population explosion among words. Forbidding structures of esoteric knowledge have threatened to restrict the domain of common discourse to a narrow range of "private" matters. Perhaps the most exciting prospect of change resulting from our new technology of information processing is the likelihood that it will halt and reverse this progressive isolation of idea from idea and man from man. Mankind, in its professional as well as its nonprofessional aspects, will again become the proper study of man.

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Computers and the World Communications Crisis

DAVID B. HERTZ

The man in charge of a computer got a little annoyed at his machine's always being right. Exasperated, he fed a question into it: "If you're so smart, tell me, is there a God?" Lights blinked and the hum of the machine became a little more high-pitched. Finally, the answer came out on the tape: "There is now!" This story typifies the attitude of the public toward the capabilities of the computer. The transformation in virtually every aspect of our lives that emerges from the volcano of the communications explosion challenges each of us individually and society totally.

As we know, communications are essential to give us the understanding we need to cope with the changes that are taking place in the world. I want to be quite specific. I believe we must build a better basis for communications within the world's institutions. I refer to the several tightly organized systems of communication that exist within our society—such as governments, schools, hospitals, businesses. Administrators, managers and executives within these organizations make decisions daily that give shape and direction to the future. Yet the communications processes employed by them do not nearly meet their needs. Indeed, managements everywhere are in a state of crisis that is beyond control by the methods of yesterday.

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Accordingly, I shall first try to describe the nature of the management communications crisis in broad terms, then briefly discuss some of the ways in which new methodology, including the computer, is being used today in communications. Finally, I shall look beyond these uses to show how computers can be applied to many of management's problems to bring about tomorrow's needed changes.

We are all engaged in both management and communications. We manage ourselves and others, and we communicate more or less widely.

The myth that the only "genuine" management is business management is one that I should like to bury right off. In the broadest possible sense, each of us—from President to professor to poet to pot-washer—manages himself, his economic and social activities, and society as a whole. Management therefore ranks as the single, ubiquitous, mind-driven activity of mankind.

In the course of this activity, we create a variety of products, using resources of all sorts, and leave the world richer or poorer as a result. Every civilization has created managers of its resources—decision-making groups, large or small—to carry out the tasks of making society run. And the achievements of any civilization have, in turn, depended upon the quality of the management of its resources.

Basic to the quality of management is the quality of communication. The hierarchy of management that starts with ourselves uses communication as a connecting thread to wind its way through multiple bureaucratic channels or institutional patterns until it reaches the decision maker at the top. All along the line, information about the

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world and its events is generated, stored, retrieved and communicated. In the process, managers make decisions and take actions that change the world and direct its events. And the world continuously returns the favor.

It should certainly be clear that the quality of the decisions must depend upon the character of the communications. And it may not be farfetched even to say that management *is* communications.

Perhaps another way to view the situation is to think of the structure of an institution in terms of the structure of an animal. The management of the institution corresponds, in this analogy, to the brain of the animal. But a brain cannot function effectively without a nervous system to send it messages and guide its actions. If the body grows beyond the capabilities of the nervous system, the animal becomes uncoordinated—it staggers. In a sense, this is what has happened today. The overloaded nervous systems of our institutions have caused them to stagger.

The institutions of the world find themselves in the midst of a management crisis primarily because the world has changed drastically and swiftly, while their management processes have not allowed them to adapt to these changes. Technology has totally outstripped technique. For example:

In *agriculture,* methods of food production, presently known, are so effective that the United States alone could feed much of the world if it so desired. Yet half the world starves because agriculture suffers from overexpansion in some countries, archaic methods in others, and inflexibility in all;

Schools and colleges throughout the world offer the great thinking of the centuries, presented for the most part in modern, well-lighted classrooms, presided over by the finest minds available to teach. Yet much of the world is illiterate, and institutions of learning everywhere struggle with acute problems of finance, personnel and organization in attempting to satisfy essential demands for better education;

Hospitals and medical care institutions are capable of preserving life and performing feats of surgery that are among today's miracles. Yet their methods of support and operation lag far behind the permanently accelerating revolutions in the life sciences, so that only a small portion of the people of the world are able to benefit from their enormous potential;

Municipalities provide housing, roads, schools, services to an immense, megalopolistic complex sheltering millions of human beings. Yet they cannot control crime in the streets;

State and federal governments collect taxes, allocate funds, build highways, even wage wars, with the most modern of methods. Yet in their vastly expanded administrative functions, they serve historical and political circumstance far more effectively than they serve public needs;

Many businesses are worldwide in nature, capable of working out the most complex production and transportation problems to assure that their goods arrive inexpensively and profitably in every corner of the world. Yet they are perilously ignorant of conditions decisive for their futures, especially those businesses that have invested heavily in defense capabilities that cannot readily be converted to production for civilian markets; and finally,

Labor unions represent skilled men who can easily build skyscrapers and dams, fashion intricate electronic networks or move massive machines, span rivers or sink oil wells. Yet in performing these tasks, they most often shortsightedly fight what they might instead capitalize on—the great promise of advancing automation.

These dichotomies between what is possible and what is performed will not go away or get solved by any time-honored management strategies. They will continue unresolved because the environments within which the institutions operate have changed beyond comprehension. As Serge Chermayeff put it, "One can no longer perform by ear or intuitively in any profession, any more than the pilot of a modern aircraft can fly by the seat of his pants. The technology is too complex, the pace is too rapid, the scale is too large, the purposes are too diversified. Even the practical man of gen-

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eralized pragmatic experience becomes less and less practical, more limited, and in an age of rapid obsolescence, himself obsolete."

The cost of change often seems to be incredibly expensive. Nevertheless, the longer these institutions fail to respond to the needs of the world, the more likely are they to be pressured into doing so, perhaps with fatal results.

Science and technology have evolved rather continuously from early man to modern times. Discoveries and inventions are seldom forgotten, and each opens the way to many others. Thus, there is steady and accelerating progress, and with it steady and accelerating changes. Conversely, the attitude of institutions toward accommodating changes tends to be conservative. Often the constituents of the institutions themselves are at fault, for they fail to communicate their needs clearly and persuasively. As a result, techniques employed by an institution to accomplish its purpose commonly remain for a long period of time at a level appropriate to the situation that existed when the institution was initially formed.

In the early stages, when technology is growing slowly, an institution can take its time about adopting new methods and ideas, for the gap between the old and the new is never very large. As the course of technology accelerates, however, the gap widens more rapidly. The institutions are quickly left behind, and suggested changes become viewed as either too radical or too costly. Often the need for change is not even admitted. In that case, the gap tends to grow wider and wider.

When this gap grows too great, the institution becomes ineffective, and strong pressures develop that force it either to change or to collapse. Often the change comes too late, and the institution does not survive in its previous state. In the case of agriculture, for example, if the starving peoples of the world arose en masse to demand that they be fed, agriculture as we know it today would have to reorganize drastically to solve the problem.

Today, however, events are moving quickly, and we cannot afford to wait. Fortunately, in the computer we have a device that can serve as a communications link between the institution and its environment and thus enable it to change economically to meet its requirements. For the first time in history, we are capable of ensuring that an institution's techniques can closely follow the progress of technology, without costly gaps.

Modern computers are what we call cybernetical in nature. That is, they communicate directly with human beings as events happen and provide a basis for control of these events. As a result, man and machine can work together to make decisions and solve problems. In this man-machine decision process, the following dialogue takes place:

Man

1. Enters data on the problem.

Machine

2. Analyzes incoming data.
3. Transmits a picture of the present course of affairs and exceptional situations in it.

Man

4. Judges the present course of affairs and the exceptional situations.
5. Requests information on problems and the resources available to solve them.

Machine

6. Searches master files and supplies the required information.

Man

7. Evaluates the situation surrounding the problem.
8. Indicates alternative actions.

Machine

9. Calculates and compares the results of alternative actions.
10. Suggests the optimum decision and near optimum alternatives.

Man

11. Selects the course of action.
12. Informs the machine.

From this interaction you can see that computers have become communications-oriented. The heart of a typical information system is a central computer that directs incoming and outgoing data from a central point or points to the entire organization. Managers can have display units on their desks that provide direct readings of infor-

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mation from the computer in written or graphic form.

Through the keyboard, the manager can "talk" directly to the computer and get answers back instantly—in plain English. In fact, he can, if he wishes, communicate with the computer orally.

This capability has changed the entire future of communications in business. For instance, the executive of a business or institution is generally deluged with paper. Now, however, it would be possible for all communications to go directly to the computer rather than to him. He could simply ask the computer to review the information it has and tell him what things he should worry about that day—or not worry about.

All the managers in an organization can also be connected to the central computer, no matter where they are located. In this way, many problems that might have been impossible to communicate about in the past could easily be solved in a few hours. Few institutions have installed such systems, however.

In the education field, computer-assisted instruction has been developed by I.B.M. It is based on the simultaneous use of many individual student "stations" linked to a central computer. The system maintains continuous control over a wide variety of learning materials, enabling the individual student to progress at his own rate. At the same time the system evaluates student responses and guides each student separately, to mastery of the subject presented. This device opens the way to the future of programmed instruction and the so-called teacherless classroom, but at the moment demand for the system is hardly widespread.

In today's hospitals, scarce and highly trained doctors and nurses spend more than half their time just shuffling paper. And in medical research laboratories, a growing mountain of data—uncollated and undeciphered—may hold the unsuspected key to fatal diseases. But a computerized information system is available that would take over the time-consuming paper work, and at the same time allow admissions people, nurses, pharmacists, doctors and researchers to have instant and simultaneous access to the stored data—and to discuss it with each other through the system. The machine would also make lab results directly available to patient-care areas and store them for future use in statistics, diagnosis, teaching and research. At least one hospital in the United States—Massachusetts General—is taking steps to install such a system.

New York City has a crime-fighting computer known as Operation Corral. Corral's UNIVAC has been fed the license numbers of thirty thousand stolen cars and eighty thousand scofflaws—traffic violators who neglect to answer summonses or pay fines.

Linked by radio to the computer, police in one prowl car simply call off a sampling of passing license numbers. As a teletypist feeds the numbers into the computer, it compares them with the stored list. When it "hits" a wanted number, a bell rings, the number is automatically typed out, and the teletypist radios ahead to a second prowl car parked some nine hundred feet down the road. The whole thing takes about seven seconds—ample time for the second car to swoop on the suspect.

While those of us to whom traffic laws are a challenge may not welcome this particular communications device, it must be admitted that cities and states could benefit greatly from the use of computers not only to help solve crime and traffic problems, but also for master planning of urban renewal and area-wide evaluation of metropolitan needs.

The federal government, of course, is the largest user of computers in the world, at a cost of more than a billion dollars a year. One of the most dramatic uses of a computer was recently made by NASA in photographing the world's first "close-up" of Mars. I.B.M. computers converted the transmitted zeros and ones into sixty-four different shades of gray to make the pictures you saw on television and in the newspapers.

Yet even the government underutilizes computers. President Johnson recently called on each department and agency of the government to set up staffs of experts to use the most modern methods of computer analysis to define the goals of their departments for the coming year. Once individual goals are established, the computer can

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choose among them for the most effective and least costly alternatives to achieving America's national goals.

Finally, today's computers possess a totally new capability—storing and processing graphic designs. In this system, blueprints and drawings, photographed on microfilm, are stored in the computer. On command, the computer can easily erase, manipulate or modify the microfilm. If, for example, you are an engineer who wants to make changes in your design of a cathode ray tube, the process is simple. By marking with a light pencil directly on the lighted display, you can literally draw in your change and the computer will ensure that it is properly integrated in the blueprint. The automobile and aerospace industries are conducting experiments on these machines, but they are not yet in use.

Perhaps I can summarize this general failure to capitalize on computer opportunities by quoting Alfred North Whitehead: "A muddled state of mind is prevalent. The increased plasticity of the environment for mankind, resulting from the advances in scientific technology, is being construed in terms of habits of thought which find their justification in the theory of a fixed environment."

Let us examine how the computer can help dispel this theory of a fixed environment. These thoughts are certainly speculative, but all are completely possible and within the state of the art now.

Agriculture is an excellent example of an area that could benefit greatly from applied computer techniques. There isn't enough food in the world. And the difference between the haves and the have-nots—the people who are eating and the people who are starving—is very great. Yet it is certainly perfectly possible to feed the world.

Instead of viewing it as a place in which each country is responsible for feeding its inhabitants, we could look at it as one unit from an agricultural point of view. The world then becomes simply many plots of ground in which differing techniques are used to produce a variety of agricultural products.

Looking at the world as one unit, we can work with the computer to learn the most effective method of producing food on each of the various plots of ground and to determine the requirements of food for all the populations of the world—both those who are starving and those who are overfed. The computer could help us decide where and how to meet these requirements effectively—what crops to produce where, what means of transportation to use, what methods of distribution to employ. This is the kind of problem that has been solved on a smaller scale in industry time and again: for example, in controlling international air traffic. Certainly, assuring that everyone has enough to eat is as important a problem for the world as assuring that airplanes depart and arrive safely.

Closely related to agriculture is the problem of education. It is useless to think of teaching people in underdeveloped countries to grow crops in the most efficient manner if they are unable to read instructions.

There are more than seven hundred million men and women in the world over fifteen years of age who cannot read or write. In certain countries of Africa, Asia and Latin America, the number of illiterates stands as high as seventy, eighty or even ninety percent of the total population, and in many countries the female population is almost entirely illiterate—although not everyone looks on that as a drawback. Despite the spectacular expansion of education for children, a by no means insignificant number of youngsters attending primary school leave before they have had an adequate schooling, and sooner or later end up as illiterates. As a result, the illiteracy rate is rising by approximately twenty-five million persons each year.

Literacy and adult education programs cannot be planned in isolation. They must become an integral part of the development plans of an entire country. The computer can achieve this integration quickly and with greater accuracy than would otherwise be possible.

In medicine, too, the time is near when every hospital will have a computer, and the education of doctors will include a

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course in computers as surely as it includes a course in anatomy. Computers will contain permanent collections of the records of all patients and all laboratory findings. They will admit patients, send bills, write prescriptions, even diagnose illnesses. Although electronic systems cannot replace the physician, they will free his time for the actual care of the patient.

More important, computers will be able in effect to increase the supply of doctors, for they will enable a patient on the West Coast to be treated by a doctor on the East Coast without either of them leaving his city.

In transportation, the long-range effect of computers could be a complete reorganization of the world's railroads. The railroads would have to be looked at as a single transportation system, free from artificial limits of national boundaries or geopolitical ideologies.

Here in the United States our major railroads have already moved in the direction of computerized systems to determine timetable changes, length of trains, train spacing, car routing, car identification, speed control and various forms of accounting. Yet how much more efficient would be a single, integrated, on-line information and control system to serve all freight and car accounting and control for the entire United States.

Indeed, this approach to railroading is vital if our problems of urbanization are to be solved. In many sections of the country, cities and suburbs are beginning to run together into gigantic semi-urban sprawls extending over hundreds of miles. This is particularly true between Boston and Washington. The adding of lanes to existing highways will eventually become impractical. Thus, motor road transportation will choke itself as the population expands and Detroit continues to turn out nine million or more cars a year.

The same problem will exist in the air. Already it takes longer to fly from New York to Washington in a 350 mile per hour airplane than it did twenty-five years ago in a 150 mile plane. The traffic in the air is so much greater that the route is now more circuitous. This problem, too, can only get worse.

The computer will doubtless help to alleviate air and highway strangulation to some extent. But a much more practical solution is to make better use of the railroads by applying computer techniques. In fact, our future transportation effectiveness may depend upon the development of satisfactory computer information processing networks.

City, state and federal governments could be significantly improved by the development of computer-based information processing networks.

One approach to this challenge would be to have all levels of government tied into the same computer-based information system. This so-called total system would include:

Horizontal communications within individual agencies, where a high degree of common information is used for the separate functions of departments;
Horizontal communication among agencies, where common information for separate city, state or federal agencies might be integrated;
Vertical communication among city, state and federal agencies, where they utilize the same information.

While businesses have made increasing use of the computer in their everyday operations —indeed, have often been forced into this action—these activities will extend further in the time ahead. Eventually, a computer will handle all elements of a business. Input devices will pick up information at the source of operations and feed it to central computers that will process it and serve it up to decision makers. For example, the status and location of any part for any job in the factory will be continuously pinpointed. A plant manager can follow the flow of work from warehouse inventory right up to the shipping gate.

For top management there will be a control room, with charts displayed on video screens to update managers on all the company's operations. The computers will be able to take up-to-the-minute information, organize it into chart form, run it through a slide-making machine, and flash it to the waiting executives. In addition, if a project is in trouble, the computer can offer and

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pretest solutions before manpower and materials are committed.

Labor unions can quite profitably utilize the computer to analyze their own interconnections with industry and their own futures.

On a worldwide scale, the computer can be used to allocate labor surpluses and labor exchanges. The Common Market is finding this approach to labor highly successful, but its efficiency is limited because the job is done by man rather than by machine. In the United States, in particular, the computer could tell us exactly what skills are needed in exactly which cities, and exactly where these skills are available. It could also calculate the best approach to take in bringing these various elements together.

In summary, the computer as a communications device holds vast promise for the future. Its possible uses are startling in their implications. Already there have been somewhat unsatisfactory attempts to have computers compose music—and who knows if one will ever write a book or paint a picture. This is not to imply that the computer will ever replace the creative artist. As one computer expert, however, put it recently, "Perhaps for the first time in man's history, he can afford to think truly long thoughts."

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The Electronic Revolution in the Pentagon

ADAM YARMOLINSKY

In the five years that I have served in the Department of Defense I have seen my share of computers. I have watched them operating in the underground headquarters of the Strategic Air Command, I have observed them humming to themselves several hundred feet under the surface of the ocean in a Polaris submarine and clicking away on the lower decks of a giant aircraft carrier. Over the last ten years, the number of computers used in Defense Supply operations has increased from three to over five hundred. But I have never seen a computer in the Pentagon itself, although I know they are around somewhere; and I have never taken part in a discussion of Defense policy in which anyone has suggested that we consult a computer.

Before proceeding further let me first attempt to dispose of the popular fallacy that computers are used in the Pentagon to make policy decisions. Computers can provide no substitute for the process of judgment based on experience. But they can make it easier to acquire and marshal the facts that can be subjected to analysis. Any tool that facilitates the collection and organization of data in a complicated and changing fact situation is a significant aid to judgment. Of course, computers are useful in assembling the facts on which to base a decision. So are typewriters, and adding machines. But no one suggests that we consult a typewriter or an adding machine in reaching a decision. Like computers, they are taken for granted.

What I am leading up to is that, at least in the realm of peacetime decision making in the Pentagon, the electronic revolution is about over, and it has left the top of the decisional pyramid relatively unaffected. There is still room for major technological advances in what is called in the jargon "real time" calculations, that is to say, calculations in which people are trying to keep up with events, and usually very rapidly moving events. But in general, the function of the computer in the policy-making process is substantially as well settled as the function of the typewriter—and no more likely to be overrated.

It may be appropriate, therefore, to ask what difference the computer has made to the policy makers in the Pentagon, and particularly what differences it has made that are peculiar to our military establishment.

We all recognize that the electronic revolution has eliminated as much clerical drudgery as the industrial revolution eliminated manual drudgery. The bigger the organization, the more of this kind of drudgery can be eliminated, and the Department of Defense is the biggest organization in the world. If there is ever a question whether it is economical to computerize any given mechanical process, that question is easiest to answer in the affirmative in the Department of Defense.

Computers can and do help when it comes to the kind of cost-benefit calculations that are normally described as an essential part of the new look at the Pentagon.

To take a single example: our forces overseas depend on the movement of huge quantities of material and large numbers of people. There are many different ways to move men and material. Time is of varying importance in each movement. To decide the most effective way of delivering a particular item (as whether by ship or plane), or whether or not the item should be pre-positioned, requires an enormous amount of data collection, and calculations

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of the various permutations and combinations of arrangements. If the electronic revolution had not taken place, all of these calculations might be so long-drawn-out and complicated that the decision maker would be inclined to put more reliance on intuitive judgment. As it is, we can call for the numbers (not figures, in the Pentagon jargon, but numbers) and expect to get them promptly and accurately. Calculations of ammunition requirements, of aircraft repair cycles, of spare parts inventories, are even more adaptable to computer operations.

But no one involved in cost-benefit calculations supposes for a moment that computer operations can take the place of human judgment. Alain Enthoven, the best known of the whiz kids, and the Assistant Secretary of Defense in charge of Systems Analysis, has pointed out that "the systems analysis approach bears no essential relationship to computers at all," and he went on to say: "In fact, ironically, my office which is sometimes alleged to be the center of computerism, and to be manned completely by computer experts, includes economists, political scientists, philosophers, engineers, and mathematicians among whom there are experienced combat veterans, some of whom are military, some civilian, and young and relatively inexperienced scholars, some of whom are civilian, some military, but not a single one of whom could in any remote sense of the term be called a computer expert. This shouldn't be surprising because the really difficult and important part of doing a good analysis is not the computation; it is formulating and defining the problem, clarifying the objectives, and determining which assumptions ought to be considered."

Nor has the electronic revolution played more than a minor role in the other major advance in the control of the military establishment, the institution of functional budgeting. Until the last five years, military spending was determined in the first instance by the civilian leaders of the government, who fixed an overall spending ceiling determined essentially by nonmilitary considerations of taxes, revenues and overall spending plans, and in the second instance, by the military heads of the Army, Navy, Marine Corps and Air Force, who cut up the pie in a series of heroic bargaining sessions conducted in the bowels of the Pentagon. With the advent of John F. Kennedy and Robert McNamara, however, both of these determinants were abandoned, and in their place was substituted an analysis of what resources were actually required for the common defense. President Kennedy gave two instructions to his new Secretary of Defense: first, to procure the forces needed to protect the security of the United States, without regard to arbitrary or predetermined budget ceilings; and second, to maintain and operate those forces in the most efficient and effective way possible.

This new determination was based on an analysis of budgetary needs that cut across Service lines, and grouped all expenditures under functional headings and subheadings; strategic retaliatory forces, continental air defense forces, general purpose forces, air and sea lift, reserve forces, and the like. Items that had previously been grouped by military service under the conventional headings of pay and allowances, or operations and maintenance, were now being arranged according to the strategic purpose to which they contributed. But this regrouping was primarily a matter of formulating and adopting new concepts, not of manipulating numbers.

It may be that the transformation of the budgeting process, within a single fiscal year, contrary to the expectation of the chief architect of the system, Defense Comptroller Charles Hitch, can be attributed in part to the ready availability of computers. But the genius of the system is to be found in human imagination and not in electronics.

The electronic revolution is probably more important to the military as it affects communications than as it affects the computers themselves. One of the sharpest lessons of the Cuba missile crisis was the essentiality of detailed control, hour-by-hour and almost minute-by-minute, of far-flung military operations, by the political author-

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ities, who are necessarily a long way from the scene of the action. To exercise this control effectively and wisely, the political authorities need to know what is going on at distant points around the world, and they need to know it as it is happening.

The transformation of the United States military establishment into a better and more responsive servant of United States foreign policy calls for the ready availability of flexible, controllable forces. That we have these forces today is partly a result of the elaborate worldwide communications network that makes up the National Command and Control System, of which the much publicized "hot line" between Washington and Moscow is only one tiny element.

Expanded and improved communications among national capitals are the subject matter of two high-level working groups just organized by the Special Committee of Defense Ministers of the North Atlantic Treaty Organization. The success of these efforts depends largely on the availability of electronic means to convey and accumulate for ready reference the masses of data required as an intelligence data base, and to maintain dependable communications lines so that military and political authorities can keep in touch as a crisis develops. But again, the hardware is only a tool, and the words that come off the teletype or out of the radio receiver are, at best, no wiser than what went in at the other end.

There is one way in which the electronic revolution may expand the scope of creative decision making—in the military establishment and elsewhere. It has been suggested that a measure of creativity is the ability to hold a relatively large number of ideas in suspension, allowing them to arrange themselves in a number of different ways. The electronic revolution offers the creative planner and strategist greater scope, as it makes available more data, assembled more rapidly, from a wider geographic range of sources, and more easily combined and recombined. The rest is up to the human mind.

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Routine

ROBERT PACK

Today was a hard one at the office.
The secretary, who always seems so shy
And never starts a conversation, wore
        a skin-tight glass dress.
Nobody seemed to notice, so I asked.
"Yes, it's true," she said, "touch it and see."
Forcing that serene objective smile
I use when addressing superiors,
I tapped her arm with my fingernail.
        A silver crack appeared—
As in ice. "Don't worry," she said, and returned
        to her typewriter.
By noon the crack had spread up her shoulder
To her neck below the ear, and down past her elbow
Where it branched out, like on a map,
        in rivulets.
She strained hard not to turn her head.
Then, below her left breast, I noticed
A dark spot, like a beebee hole,
        and I was anxious.
"Hadn't you better change?" I asked,
And she replied, "Proceed at your own risk."—
Which was, I thought, a gauche thing to say.
I began to chip and peel away the glass,
Getting better at it as I went along,
        becoming, I might say,
Really quite adept, though in some places

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Innate modesty impeded my work.
When I finished, I discovered she was
completely dressed—
In a ski outfit. "Why?" I asked.
"I'm planning a vacation," she said.
By then I was curious and had lost much
of my reserve,
So I carried her to the supply room
Where I stripped away a mink coat, a raccoon coat,
Two cashmere sweaters, three dresses, a blouse
With a round collar and a butterfly pin on it,
and a dickey,
But when at last I reached her underclothes,
She sniffled and whimpered, "Haven't you gone too far!"
Naturally, I felt ashamed, so I folded her
Into a manila envelope, and mailed her,
with no return address,
To the office manager of a competing firm.

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Literature and Society

RICHARD HOGGART

To begin with, two assertions: first, without appreciating good literature no one will really understand the nature of society; second, literary critical analysis can be applied to certain social phenomena other than "academically respectable" literature (for example, the popular arts, mass communications) so as to illuminate their meanings for individuals and for their societies. These are the two themes of this essay. They are obviously related but the first is the more important and the second the less obvious.

Many students of society—historians, social scientists, political scientists, philosophers—find the study of works of literature useful and readily say so. They do not feel threatened by a different kind of discipline or seek to acquire stature from stressing their subject's special mysteries. More important, the high degree of imagination necessary for really distinguished work in any of the humanities or social sciences ensures that men with such powers do not mistake the necessary technical boundaries between academic disciplines for divisions within human experience.

Yet it is still not easy to define exactly in what ways literature illuminates society. One is pointing to something more than the use of literature as documentary illustration, a source of raw material from whatever period one is studying, a quarry to be raided for "background." One is not simply talking about a mass of evidence that interestingly shows the life of an age but acts only as illustration of the judgments one then makes about a society *from outside literature* as a historian or philosopher or social scientist. One is arguing that literature provides in its own right a form of new and distinctive knowledge about society.

It would be foolish to deny or underestimate the documentary use of literature. Literature can serve such a purpose, most usefully. Imagine a long line of books, all of them normally studied in courses on literature. At one end might be books felt by historians or political scientists or philosophers to belong to their fields as much as to the literary students'—memoirs, works of philosophy, diaries, letters, essays (and writers such as Defoe, Bunyan, Swift, Pepys, Burke, Newman). Toward the middle are mixed kinds of writing such as philosophical poetry (for example, *An Essay on Man*) and those novels that most evidently illustrate elements in their ages (there is a huge range within a range here, from Sterne through Samuel Butler's *The Way of All Flesh* to much of Charles Dickens). Right at the other end of the line are works that seem more "purely literary," in the sense that their value to students of society is not at first obvious (T. S. Eliot's *Four Quartets* would be a recent example).

Not all these works will have to anything like the same degree that "something more" than illustrative value we have so far only hinted at. How much of this value they have depends on two things: on their intrinsic power, their power as works of literature; and on our ability to read them as works of literature, rather than to use them as quarries for extraneous buildings. Properly read—read in and for themselves, with an openness to the author's imagination and art—works of literature give an

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insight into the life of an age, a kind and intensity of insight, which no other source can give. They aren't a substitute for these other sources, and to think so would be foolish. But it is just as foolish to think that these other sources can be sufficient in themselves. Without the full literary witness the student of society will be blind to the fullness of a society's life.

What are these "intrinsic," these peculiar, qualities of literature to which a good reader attends? Good literature re-creates the sense of life, its weight and texture. It re-creates the experiential wholeness of life —of the life of emotions, the life of the mind, the individual life and the social life, the object-laden world. It creates these things all together and interpenetrating, as they do in the lives we live ourselves. Tolstoi knew that a whole range of dissatisfactions felt by an upper-middle-class Russian woman in the nineteenth century would suddenly find their focus and demand action when she saw, as though for the first time, the hair sprouting from her distinguished husband's ears. Conrad never ceased to wonder (even more than other novelists) at the way a little gesture, something about a man's clothing or a woman's voice, could focus a whole personal and social situation. Experience is much more complicatedly, much more fluidly, interinvolved than we like to remember; literature makes it harder for us to forget.

Good literature re-creates the immediacy of life—that life was and is all these things, all these different orders of things, *all at once*. It embodies the sense of human life developing in a historical and moral context. It re-creates the pressure of value-laden life so that—to the extent of the writer's gifts and art—we know better what it must have meant to live and make decisions in that time, at that place, to have thought and felt, to have smelled roast beef, been troubled by falling hair and wondered what we were making of our lives.

Most important of all, literature seeks a new kind of wholeness—to trace the pattern or movement that can lie behind the apparently inchoate details of life. Henry James's novels, to take an obvious instance, often work out polarities between innocence and experience in the life of individuals and between societies (innocent America and experienced Europe), polarities not "objectively" evident but nevertheless—he believed—at work deep within individual and national psyches.

Through literature "we know better what it must have meant . . . ," I said a few paragraphs back. Perhaps I should have said "we *feel* we know better." For is our response to literature really a form of knowledge, and if so in what sense?

Some people say it is not. Novels are all very interesting, they may say, and admit that they enjoy reading them. But they don't, they continue, confuse them with *knowledge*. Novels are inventions, fabrications, imaginings. They don't tell us "what it must have meant" or, if they are about contemporary life, "what it really means"; they tell us what someone imagines it must have meant or must mean. They tell us something about him—the writer, in there; not about them—other people, out there. They have no representative significance or meaningful outer reference. They do not therefore belong to the pursuit of knowledge as these people define it, which is the effort after and the considered interpretation of objectively verifiable material, independent of the personality of the inquirer.

As a deliberately adopted professional position (a technical stance) this can, in certain circumstances, be admirable; as a general statement about human life it is one-eyed. In some disciplines one must act as though all knowledge were scientifically verifiable (and in some subjects it can be so defined). In the study of society it cannot. Sociological and social-psychological techniques are already immensely sophisticated and rightly grow more sophisticated every day; they are still crude in comparison with the complexity of what an unskilled laborer feels on his pulses every day of the week.

Cyberneticians say that even their most advanced computers have only a minute proportion of the operational efficiency

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of the brain of a not very well-endowed or well-trained human being. You have to go much further than that if you want to describe adequately not only the intellectual but also the emotional life of human beings. Yet it is plain that social scientists as social *scientists* (that is, as developers of an academic discipline, a way of probing knowledge) must act *as if*—; must act as if all knowledge about the life of human beings can be caught within their procedures. The experimental social scientists are therefore likely to suspect those in their number who mix knowledge and opinion, objectivity and intuition. Like the early natural scientists, they fear a relapse into alchemy.

But as an overall view about human experience the idea that there is only one gate to knowledge, one kind of gate, is a form of mental color blindness; and the second kind of knowledge is as difficult to describe to some people as is color to a color-blind person:

> Thus they fall to denying what they cannot comprehend . . . they like to discern the object which engages their attention with extreme clearness . . . their disposition of mind soon leads them to condemn forms, which they regard as useless and inconvenient veils placed between them and the truth.

Somewhat earlier than Tocqueville, who wrote the above passage, William Blake had put it more tartly:

> May God us keep
> From single vision and Newton's sleep.

A much more recent advocacy of the double (and unified) vision is to be found in Herbert Marcuse's *One-Dimensional Man.*

The heart of the case is that poetic, metaphoric, intuitive understanding *is* a form of knowledge although it cannot be objectively measured; that its validity depends on the imaginative power of the author ("imagination" includes penetration, complexity, honesty) and on our capacity as readers to test it against our own sense of experience. We will "go along with" an author so long as he keeps our confidence on all these counts. Such knowledge is not as finally, or as comfortably, provable as "objective" knowledge. It is not a whit less difficult to arrive at:

> Poetry is as exact a science as geometry. Induction is as good as deduction . . . No doubt my poor Bovary is suffering and weeping in twenty different French villages at this very moment.

A hundred years later W. H. Auden made the same point as Flaubert made above, less colorfully but with greater intellectual weight. He was writing about Henry James's *The American Scene* (James, of course, thought long, deeply and with an absorbed sense of craft about those "facts" which, seen from the exact right angle, throw a revealing light on a whole life or class):

> In grasping the character of a society, as in judging the character of an individual, no documents, statistics, 'objective' measurements can ever compete with the single intuitive glance. Intuition may err, for though its judgment is, as Pascal said, only a question of good eyesight, it must be good, for the principles are subtle and numerous, and the omission of one principle leads to error; but documentation, which is useless unless it is complete, must err in a field where completeness is impossible.

Poetry is "as exact a science as geometry"; the principles of intuition are "subtle and numerous." There is nothing easy here, no vague sense that because "X," the writer, "feels it down there" and feels he feels it deeply then it must be true, interesting and important.

A good writer can give us a sense of the formative but largely submerged currents in an age's life. From Jane Austen's books, quite apart from their considerable value as social documents, one of the great rewards is this sense of the way life was lived "in the bone" at her time—that behind people's actions and reactions lay *this* particular sense of England's destiny, *these* assumptions about the relations between the sexes, about class and money and duty. Similarly although more broadly we gain from the great nineteenth-century Russian novelists a wonderfully close sense of the inwardness of Russian life at the time—mercifully, in view of the much

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more prescribed access one has today to Russian life. The earlier insights give at any rate some imaginative perspective.

Occasionally a single moment, placed just at the right point, brings together and contains within itself a world of individual and social meanings, becomes a comprehensive unstated statement about that time, that place, those people and that sense of value (and in so doing also transcends its time and place). Tolstoi and Dostoevski especially have this power. But my own favorite among the great Russian novels is the scene in Turgenev's *Fathers and Sons* when the main character, young Bazarov, dies. Bazarov is a revolutionary "nihilist" intellectual, brilliant but baffled in many ways (a metaphoric relative of Hamlet). His parents are loving, but conservative and uncomprehending. At the close of the book they hover miserably round his sickbed until the end comes. Their reaction then is terrible and pathetic, and brings together in one great dramatic moment a whole range of insights about the gaps between and the love between generations, about youthful idealism, about Russian political and intellectual life, about the tragic absurdity that the universe can seem to be. (It is a moment not unlike that in which Lear refuses to believe that Cordelia is dead; to do so would be to admit that a meaningless cruelty pervades the world.)

As night approached he sank into a state of coma, and, on the following day, expired. Father Alexis performed over him the last rites of religion, and at the moment when Extreme Unction was being administered, and the holy oil touched his breast, one of the dying man's eyelids raised itself, and over the face there seemed to flit something like an expression of distaste at the sight of the priest in his vestments, the smoking censer, and the candles before the *ikon*.

Finally, when Bazarov's last breath had been drawn, and there had arisen in the house the sound of 'the general lamentation,' something akin to frenzy came upon Vasili Ivanitch [the father].

"I declare that I protest!" he cried with his face blazing and quivering with fury, and his fist beating the air as in menace of some one. "I declare that I protest, that I protest, that I protest!"

Upon that old Arina Vlasievna, suffused in tears, laid her arms around his neck, and the two sank forward upon the floor. Said Anfisushka later, when relating the story in the servants' quarters: "There they knelt together —side by side, their heads drooping like those of two sheep at midday."

Such a passage respects what Keats called "the holiness of the heart's affections." We shall not understand human societies unless we try to understand how in all periods experience is felt in the heart like that.

Among English novelists Hardy had similar powers (it is part of what we mean by calling him a "poetic" novelist). There is a scene in *Tess of the D'Urbervilles* in which Tess, the ignorant and innocent country girl who has been betrayed by a well-to-do young man and had an illegitimate baby, realizes that the tiny infant is about to die. She is in the cottage bedroom which she shares with her sisters and brothers and is almost beside herself. But one thing she is determined about: the baby must be baptized. She performs the ceremony herself. In that ceremony Hardy brings together an intricate network of observations about the terms of life for such a girl in such a society (and about much else in human nature at any time). But it is crucial to realize that what makes the scene effective is not that Hardy overtly makes it "representative," but that he keeps his eye honestly on the particulars. Tess's face, far from being some generalized symbol for outraged womanhood or the plight of peasant maidens, is seen and described as a rough-skinned country girl's face but now, because of the softening weak light of the candle, strangely transfused:

Tess then stood erect with the infant on her arm beside the basin, the next sister held the Prayer Book open before her, as the clerk at church held it before the parson; and thus the girl set about baptizing her child.

Her figure looked singularly tall and imposing as she stood in her long white nightgown, a thick cable of twisted dark hair hanging straight down her back to her waist. The kindly dimness of the weak candle abstracted from her form and features the little blemishes which

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> sunlight might have revealed—the stubble scratches upon her wrists and the weariness of her eyes—her high enthusiasm having a transfiguring effect upon the face which had been her undoing, showing it as a thing of immaculate beauty, with a touch of dignity which was almost regal. The little ones kneeling round, their sleepy eyes blinking and red, awaited her preparations full of a suspended wonder which their physical heaviness at that hour would not allow to become active.

That is the way art releases its meanings, by looking honestly at the object until the meaning emerges of its own volition, not by rigging up the scene as symptomatic documentation.

One of the most impressive and sustained of all such incidents in the English novel is in Chapter 74 of George Eliot's *Middlemarch,* which describes how Mrs. Bulstrode, the banker's wife, learns of the secret in her husband's past and of its public disclosure, and how—a proud woman, deeply characteristic of the strength and limitations of her class—she faces the new terms of her life. The chapter begins quietly, like a symphony stating simply one of its main themes:

> In Middlemarch a wife could not long remain ignorant that the town held a bad opinion of her husband. No feminine intimate might carry her friendship so far as to make a plain statement to the wife of the unpleasant fact known or believed about her husband; but . . .

Then the nightmare unfolds as gossip mounts, and Mrs. Bulstrode, with immense hurt dignity and honesty, forces herself to go around town and fully discover the situation ("I must say it of Harriet that she wishes to do right," says one of the gossips). In the end the worst is revealed and she faces it. She faces it without evasion, although a whole moral code has been outraged and a whole social position destroyed. The chapter moves to a conclusion in which all the elements come together in a superbly complex and moving resolution, *acted out* by a human being.

What the novel can supremely give, then, is a sense of the texture of life as it is lived; and of the way in which that texture is all the time shot through with choices. George Eliot presumably had this in mind when she described the novel as "moral" and stressed the importance to the novelist of "truth of feeling" and "reverence." "If it [the novel] does not enlarge men's sympathies, it does nothing morally," she said, and also spoke of her conviction "that our moral progress may be measured by the degree in which we sympathize with individual suffering and individual joy."

"Moral" in this context does not mean "moralizing," enunciating ethical precepts. It means exploring the ways in which we are day after day up to the neck in value judgments, whether by commission or omission; it means recognizing the fact that our lives are irradiated with qualitative commitments, and recognizing too the almost incredible complexity of these relationships. I sometimes wonder whether the irritation of some social scientists at the irruption, into the discussion of society, of evaluative opinion comes less from a necessary professional strictness than from a panic sense of the fantastic difficulty of measuring and assessing these qualitative elements.

George Eliot claimed in the passage quoted above that in carrying out this moral exploration the novel "enlarged men's sympathies." In a famous passage D. H. Lawrence said much the same:

> It can inform and lead into new places the flow of our sympathetic consciousness, and it can lead our sympathy away in recoil from things gone dead.

Students of literature would naturally like to think this is true, that the novel does —or can—have such profound effects on the personality. The argument with outsiders about whether it does so or not is persistent, complicated and bedeviled by semantic difficulties. At this point in this essay I am saying something simpler: that the sense of the *qualitative* complexity of social life that the novel can give is irreplaceable.

So far our examples have been drawn chiefly from novels. In some respects it is easier to talk about their social relevance than about that of the drama or—even

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more—poetry. The novel so much more obviously holds a mirror to its age. But in what sense can poetry help the student of society? Here, as with the novel, nothing but the best will do. The best criteria, that is; it would be crass, for the sake simply of making connections, to sell poetry—or the study of society—short.

The poet is distinguished from the novelist (although it is a distinction of degree, not kind) in three chief ways. First, he speaks more often in his own person. His witness is more direct and contemporary. He is less likely to explore and re-create how people a century or so ago lived and moved and had their being; he is more likely to be saying, in effect, "this is how *I* feel" or "this is what a hawk looks like to me from the middle of a city street in 1966."

Second, the poet's relation to language is more tense than the novelist's. It is even more difficult to paraphrase him. The language he uses is even more than the novelist's organically a part of what he is saying, not only a vehicle for thought or feeling but a fulfilling of, a bodying out of the pressure of that thought and feeling. Fourteenth-century England, the early seventeenth century, the Commonwealth and Restoration: we shall only discover what Chaucer, Donne and Milton illuminate in these periods if we read their poetry in all its fullness as poetry. Their language expresses the temper of their minds, and their tempers exemplify crucial elements in their ages.

Third, the poet is likely to be more concerned about technique than the novelist. But again the form, like the texture of the language, is part of what is being said; the structure chosen and the other technical devices are not an escape from experience but a way of holding experience under pressure. Poetry has been said to present "imaginary gardens with real toads in them." The imaginary gardens are the aesthetic devices of poetry, the real toads the unevaded issues of experience. The toads are there and real enough; but you will only understand some of the more disturbing elements in their reality if you pay your entrance fee to the imaginary garden.

Wordsworth is a good example of the different ways a poet can speak for his age. Deeply involved in that important movement from eighteenth-century to nineteenth-century ways of thought, he responded to the challenge at its deepest psychic levels, as a challenge to define one's humanity and one's relations to the world outside man.

At times he wrote directly and discursively, for instance, in the Preface to *Lyrical Ballads* with Coleridge (after these two the line of direct social criticism by poets runs up through Matthew Arnold to T. S. Eliot). But his greatest explorations of the pressure of his age are in his poetry itself. It is not surprising that John Stuart Mill should have stressed the value of Wordsworth's poetry to him:

> What made Wordsworth's poems a medicine for my state of mind was that they expressed, not mere outward beauty, but states of feeling, and of thought coloured by feeling, under the excitement of beauty. They seemed to be the very culture of the feelings, which I was in quest of. (Autobiography)

"The very culture of the feelings." Some of the Great Victorians still had a sense of the unity of being. Darwin could say with impressive humility that when, late in life, he found himself no longer able to read poetry he knew that—whatever the achievements of his long service to science—something had withered in him:

> My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone, on which the higher tastes depend, I cannot conceive. A man with a mind more highly organised or better constituted than mine, would not, I suppose, have thus suffered; and if I had to live my life again, I would have made a rule to read some poetry and listen to some music at least once every week; for perhaps the parts of my brain now atrophied would thus have been kept active through use. The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature. (Autobiography)

In Wordsworth's poetry the outstanding text in this connection is the long poem

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"The Prelude." But the hundred and fifty lines of "Tintern Abbey" provide a marvelous introduction to a crucial moment for Wordsworth and for his age, in their questioning of the interrelations between the natural and the human orders:

These beauteous forms,
Through a long absence, have not been to me
As is a landscape to a blind man's eye:
But oft, in lonely rooms, and 'mid the din
Of towns and cities, I have owed to them,
In hours of weariness, sensations sweet,
Felt in the blood, and felt along the heart;
And passing even into my purer mind,
With tranquil restoration:—feelings too
Of unremembered pleasure: such, perhaps,
As have no slight or trivial influence
On that best portion of a good man's life,
His little, nameless, unremembered, acts
Of kindness and of love. Nor less, I trust,
To them I may have owed another gift,
Of aspect more sublime; that blessed mood,
In which the burthen of the mystery,
In which the heavy and the weary weight
Of all this unintelligible world,
Is lightened:—that serene and blessed mood,
In which the affections gently lead us on,—
Until, the breath of this corporeal frame
And even the motion of our human blood
Almost suspended, we are laid asleep
In body, and become a living soul:
While with an eye made quiet by the power
Of harmony, and the deep power of joy,
We see into the life of things.

There is an interesting comparison with a later poem, by Tennyson, which on the face of it may seem more likely to illuminate its age than much of Wordsworth. I am thinking of the long and very impressive poem "In Memoriam." One of its themes is the struggle between faith and doubt, and in this respect it is certainly an essential document in the development of that argument during the mid-nineteenth century:

Be near me when my faith is dry,
And men the flies of latter spring,
That lay their eggs, and sting and sing,
And weave their petty cells and die.

Be near me when I fade away,
To point the term of human strife,
And on the low dark verge of life
The twilight of eternal day.

Yet, without underestimating Tennyson or "In Memoriam," one has to say that this poem tells us less about its age than some of Wordsworth's poetry, even when Wordsworth's poetry is not directly about its age.

Finally, a modern example. The great bulk of W. B. Yeats's poetry provides unusually good evidence of the different ways in which—the different degrees to which—poetry may speak for its time, as it moves from his early poetry of the Celtic Twilight to his directly political poetry (such as the magnificent "Easter 1916") and finally to the apparently unpolitical but more deeply representative late poems.

There is not time to say much about drama. Still, much of what one says about poetry and the novel is true of the drama too. But if one obvious special strength of fiction is the *fullness* of its re-creation of an age's life, and of poetry a particular attention to language and form as means of inquiry, then one can say that a peculiar strength of drama is its capacity to reveal truths about an age by indirection, mythically, by an oblique "showing."

"Tell all the truth but tell it slant/Success in circuit lies." Some of the more difficult truths about the soul of an age best reveal themselves when told "slant." Look, today, at the work of Beckett and Pinter, work unmistakably about the quality of men's lives in the mid-twentieth century but work that scarcely ever makes a direct statement about those lives.

Near the beginning of this essay I said that the value of literature to the student of society will depend on two things: its intrinsic quality and the student's capacity to read it properly. To read a book properly is harder than we realize, a difficult effort in giving disciplined, dispassionate and full attention to language and form. A book of any quality cannot be gutted or winnowed; it is a very complex organism.

It is also extremely difficult to state analytically, once a book has been read, what its representativeness really consists in; and literary people sometimes make illegitimate extensions from literature into life, assume that what has only been asserted has been proved. T. S. Eliot could make

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particularly brilliant, fascinating and seminal correlations, but has rightly been criticized for a kind of cavalier quality in some of them:

> The difference is not a simple difference of degree between poets [in this case between Lord Herbert and Tennyson]. It is something which had happened to the mind of England between the time of Donne or Lord Herbert of Cherbury and the time of Tennyson and Browning; it is the difference between the intellectual poet and the reflective poet. Tennyson and Browning are poets, and they think; but they do not feel their thought as immediately as the odour of a rose. A thought to Donne was an experience; it modified his sensibility.

That passage has been a favorite, and a good stimulant, to many literary critics. The assumptions it makes are staggering: they may be true; yet neither Eliot nor any of those who used the passage later have examined its extraliterary implications. But this indicates chiefly that we need to work much more at the frontiers we share with other students of society; to make connections is right and relevant—they must be made.

It is as hard to describe the imaginative whole that is a great work of literature as to describe a symphony or a great painting. At his best a good literary critic shows a sensitive and intelligent respect for the author's creation in itself, a disciplined openness before the author's way of looking at experience, a recognition of his own biases and a refusal to cut corners on their behalf in discussing the texts. I do not say this so as to stress how impressive good critics can be, but to underline that a literary work of any consequence is not a collection of impressions, of "pure emotion" (whatever that may mean), or the product of some nonsignificant formal or aesthetic game. A work of literature, and so the skill (criticism) that analyzes it, differs from nonartistic explorations of experience (for example, philosophy) because it does not abstract-out the elements of experience; it starts and finishes with experience as a whole, "blood, imagination, intellect running together." To recognize this wholeness, this intellectual/emotional/mythopoeic immediacy, and to learn how to respond to it in literature, is a necessary part of knowledge, without which we shall not see far in any other discipline (or in our own lives, since they will even less bear the abstractions of a single vision).

This essay's second subject, it will be remembered, is the use of literary criticism in understanding popular art, mass art and some other forms of mass communication—advertisements, romantic novelettes, cartoons and strip-cartoons, sex-and-violence novels, popular song, the press, women's magazine fiction, radio and television, film (although to some extent discussion of film already has its own critical language).

Work of this kind has been done by a small number of British literary critics for the past few decades. In America much more has been done: a useful first guide, in some of its essays and in its bibliography, is *Mass Culture,* a paperback published by the Free Press of Glencoe (although most of the essays it reprints are by social scientists, it includes some literary critics' work, names others and gives an idea of the close relations between parts of the two disciplines). In Britain the more important earlier contributors include Dr. and Mrs. Leavis and Denys Thompson; and, from a different angle, George Orwell.

At this point we are specifically discussing the close practical analysis of material. But it is as well to say now, parenthetically, that this close work has usually been supported by a number of generally accepted ideas about contemporary cultural conditions (about the relations among folk, mass and popular art; about minorities or elites; about high, middle and low brows). Some of its foundation documents are the Preface to *Lyrical Ballads* which was mentioned earlier, Matthew Arnold's *Culture and Anarchy* (1869) and, in this century, Ortega y Gasset's *The Revolt of the Masses* and T. S. Eliot's *Notes Towards the Definition of Culture.*

In general the picture of contemporary cultural conditions that has been assumed by most British teachers of literature who

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have worked in this field, although it has considerable strengths, is too limited. It is insufficiently responsive to the complications of contemporary cultural conditions and so to the meanings of much contemporary art at all levels. Popular and mass art is more varied than it recognizes (and what professes to be "high art" sometimes no more than a profession), and the continuity and change within working-class attitudes more complex than it allows for. Among recent books Raymond Williams' *Culture and Society* and *The Long Revolution* and Edward Thompson's *The Making of the English Working Class* valuably extend our understanding of the latter.

But to come back to the discussion of detailed analysis. Briefly and generally, this has one aim: through literary criticism to see better the thing as it is, its texture and inner nature. It has two main lines of approach: detailed analysis of rhetoric, and the study of larger meanings (myth, archetype, pattern, theme). In both approaches, and they are obviously linked, the assumption must be that the productions have *in some ways* the kind of relation to language and to their audiences that "high art" has, and are therefore susceptible to similar analytic approaches (that these relations are often simpler, more "processed" or "stereotyped" in "mass art" than in "high art" does not disprove the assumption; part of the purpose of the inquiry is to test and define these terms better). This needs stressing to those literary critics especially who think that only recognized works of literary art can be critically analyzed, and that the rest—"lowbrow art," to use a favored portmanteau expression which conflates a number of different forms—is as simple as bubble gum. This is a crude, culturally conditioned error in the face of an interesting and challenging set of relationships.

A related view—more common among social scientists—is that mass art can be explained simply in commercial and economic terms; that it is wholly and deliberately a devised product for an audience whose tastes are pretty exactly known.

The commercial and economic connections of mass art certainly need to be understood better. But both these views simplify and minimize the relationship between the producers and their audiences, the producers and their material, the audiences and the material, and the interactions between different forms and different levels of taste.

But suppose we assume that these productions have at least something of the character of traditional forms of art and so can be analyzed in themselves. A few social scientists will nevertheless still see no point in such analysis; no point for the social scientist, that is. They will argue that there can be no such thing as "the work in itself," that that formulation is an *ignis fatuus,* a way of claiming absoluteness for what is itself a socially conditioned matter; that what is meant by "the work of art in itself" is what particular authors, with their kind of background, thought they were creating, thought they were effecting in their readers, or what a group of critics —at a particular time or in a "literary tradition" that has continued for a long time —agree, because of their common socially conditioned assumptions about art, to call "the work of art in itself." So (these social scientists will continue), although social scientific analysis of these assumptions themselves might be useful, since it would tell you something about these authors and these critics, it would tell you little about what any individual reader or viewer—especially if he did not "share a tradition" with the author or critic—made of or took away from any work. With the mass arts in particular this is a crucial consideration, since audiences and would-be literary critics of the mass media certainly do *not* "share a tradition." By and large therefore, if you wish to study the effects of mass communications you had best confine yourself to effects-analysis drawn directly from audience studies. We know from existing effects-analysis, these social scientists conclude, that what is taken from the same production varies enormously from person to person, that we are all highly selective in our reading (or hearing or viewing). What is taken is decided by factors best analyzed by

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sociological or social-psychological methods, not by reference to some artistic tradition assumed to be shared by authors, critics and audiences.

Because it is not close enough to the theme of this essay, we can leave aside the question of the relativity of *all* literary standards (it is, though, an appallingly difficult question and not enough looked at by any of us). We can agree that certain kinds of effects-analysis (particularly psychological analysis) must keep itself clinically to itself. Outside that, the suspicion or dismissal of literary critical analysis as purely relativist or "mere impressionism" is a disabling myopia, as silly as cutting off one arm for the greater glory of the other.

Outside strict, clinical effects-analysis it is important on several counts for the student of mass communications within the social sciences to have a good sense of the contribution literature and literary criticism can make to his studies. They can help to bring to the light better, like a brass-rubbing, the texture of mass communications, and so inform consideration of their impact below the "objective" level. They can help the social scientist to avoid setting up questionnaires or other tests that are inadequate because they contain built-in assumptions that a close sense of the "things in themselves" could have prevented. The social scientist who began an essay on the social significance of television with the major assumption that television is essentially "entertainment" might have been saved from that disabling start if he had thought more carefully in the first place about the nature of social structures and so of the degree to which what a medium *is* is pre-decided by the structure within which a society makes it operate. But the same result could have been achieved if he had reflected better on the material itself. The social scientist who, in assessing the effects of television on "serious" cultural pursuits, constructed a scale of ascending seriousness running from comic books through the *Reader's Digest* to the *Book-of-the-Month* could only have been saved from such irrelevance and unreality by the closest analytic understanding of the nature of *things in themselves.*

Literary critical understanding can help to make content analysis more subtle. Content analysis is now much more sophisticated than it was a few years ago, but is still almost always insufficiently alert to the inner character—and so likely effect—of many forms of mass communication (for example, most sociological analyses of crime-and-violence series on television leave you wondering whether their authors have ever *felt* the appeal of one of them). Lastly, literary criticism, in cooperation with other relevant disciplines, can help to set the phenomena of mass communications in a deeper social and historical context than any of us, working alone, have so far managed.

All in all, then, literary critical analysis of the mass arts is not a substitute for social scientific analysis but a useful—an essential—adjunct. It is difficult to do well and those of us who try to do it make some bad mistakes; but we are beginning to learn.

Of literary criticism's two main approaches to nontraditional material the first, it will be remembered, is the analysis of rhetoric. "Rhetoric" is not used in a depreciatory sense but as a comprehensive term for qualities of style, particularly those that assist persuasion or assent, that carry the relations between writer and reader. Special attention therefore needs to be paid to tone and manner.

It will be useful to introduce this sort of analysis by reference not to nontraditional material but to authors who would normally be studied in a course in English literature. Compare the openings of two novels by twentieth-century writers. E. M. Forster's *Passage to India* begins:

> Except for the Marabar Caves—and they are twenty miles off—the city of Chandrapore presents nothing extraordinary. Edged rather than washed by the river Ganges, it trails for a couple of miles along the bank, scarcely distinguishable from the rubbish it deposits so freely. There are no bathing-steps on the river front, as the Ganges happens not to be holy here; indeed there is no river front, and bazaars shut out the wide and shifting panorama of the stream. The streets are mean, the temples in-

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effective, and though a few fine houses exist they are hidden away in gardens or down alleys whose filth deters all but the invited guest . . .

D. H. Lawrence's *Sons and Lovers* begins:

'The Bottoms' succeeded to 'Hell Row.' Hell Row was a block of thatched, bulging cottages that stood by the brook-side on Greenhill Lane. There lived the colliers who worked in the little gin-pits two fields away. The brook ran under the alder-trees, scarcely soiled by these small mines, whose coal was drawn to the surface by donkeys that plodded wearily in a circle round a gin. And all over the countryside were these same pits . . .

The contrast in tone is striking. The passages have very different emotional keyboards, partly because the authors are different individuals, partly because the passages serve different artistic purposes, partly for socio-cultural reasons. By close attention to individual words and images, to syntax, to stress, to the movement of each passage, one can just begin to make some presumptions—although it is a difficult and delicate business at any time and much more so with short extracts—about each author's sense of his audience and his society, about the assumed relations between literature and social class, about other assumptions shared and unshared.

A comparison across a stretch of time shows such differences even more clearly. Here are two moments of vocational-revelation in fiction, separated by three-quarters of a century. George Eliot describes the moment at which Lydgate in *Middlemarch* becomes destined to be a doctor:

The page of the Cyclopaedia he chanced to open was under the head of Anatomy, and the first passage that drew his eyes was on the valves of the heart. He was not much acquainted with valves of any sort, but he knew that valva were folding-doors, and through this crevice came a sudden light startling him, with his first vivid notion of finely-adjusted mechanism in the human frame. A liberal education had of course left him free to read the indecent passages in the school classics, but beyond a general sense of secrecy and obscenity in connection with his internal structure, had left his imagination quite unbiased, so that for anything he knew his brain lay in small bags at his temples, and he had no more thought of representing to himself how his blood circulated than how paper served instead of gold. But the moment of vocation had come, and before he got down from his chair, the world was made new to him by a presentiment of endless processes filling the vast spaces planked out of his sight by that wordy ignorance which he had supposed to be knowledge. From that hour Lydgate felt the growth of an intellectual passion.

Tench, the broken-down, expatriate dentist in Graham Greene's *The Power and the Glory* has a similar moment of revelation:

'Oh, it will be hours yet,' Mr. Tench assured him again.

'Hours? Are you certain? It's very hot in the sun.'

'You'd better come home.'

Home: it was a phrase one used to mean four walls behind which one slept. There had never been a home. They moved across the little burnt plaza where the dead general grew green in the damp and the gaseosa stalls stood under the palms. Home lay like a picture postcard on a pile of other postcards: shuffle the pack and you had Nottingham, a Metroland birthplace, an interlude in Southend. Mr. Tench's father had been a dentist too—his first memory was finding a discarded cast in a waste-paper basket—the rough toothless gaping mouth of clay, like something dug up in Dorset—Neanderthal or Pithecanthropus. It had been his favorite toy: they tried to tempt him with Meccano, but fate had struck. There is always one moment in childhood when the door opens and lets the future in. The hot wet river-port and the vultures lay in the waste-paper basket, and he picked them out. We should be thankful we cannot see the horrors and degradations lying around our childhood, in cupboards and bookshelves, everywhere.

These comparisons of passages out of contexts are no more than introductory runs; this sort of analysis can only be done properly within the context of a whole book. Even then, to define social and cultural changes accurately is hard work—to distinguish between elements peculiar to the author, those that are part of his artistic strategy, and those that are representative, that hint at changes in society, in assumptions, in the sense of available audiences. But insofar as it does succeed this work uniquely assists understanding of the

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society within which a book has been written.

Less importantly, the same kind of approach can be applied to any piece of persuasive prose—to advertisements, speeches, public statements. There is a fair number of books that describe and give practice in this sort of work. This recent advertisement is particularly worth analyzing; it could be the starting point for an essay on the sixties, and a society's images of itself:

> Cliff Adams is like that. He faces a situation, makes a decision and sticks to it. Commercial TV started and he started with it. Writing and arranging music for commercials. One of his first for Fry's Turkish Delight is still around. And he still likes it.
>
> This is the new type of Englishman. The professional. There's nothing of the dilettante about Cliff. Nothing of the frustrated musician who apologises for commercial work saying he'd really like to write a symphony. Cliff Adams works to order. He works for money. And what he does, he does very well indeed. He says this attitude is what the English revolution is all about. He talks about how people have changed. How they face things squarely. Want life to be straightforward, not full of unwritten rules. He says it shows in everything they do. The way they dress, talk, write, think, even drink. He talks about what people drink nowadays. He says it's vodka. Cossack Vodka because it's a clean drink. Cossack Vodka because it's straightforward and makes no pretence.

Or consider the mild persuasive sophistications of this defense of commercial television:

> If you decide to have a system of people's television, then people's television you must expect it to be. It will reflect their likes and dislikes, their tastes and aversions, what they can comprehend and what is beyond them. Every person of common sense knows that people of superior mental constitution are bound to find much of television intellectually beneath them. If such innately fortunate people cannot realise this gently and considerately and with good manners, if in their hearts they despise popular pleasures and interests, then of course they will be angrily dissatisfied with television. But it is not really television with which they are dissatisfied. It is with people.

More difficult and interesting is the comparison of literature of violence at different "levels"; we soon find that many of our assumptions about the differences between good and bad literature do not serve well under pressure, and that the social implications of the comparisons are not easily grasped or, when grasped, always palatable. In all such exercises it is crucial to work outward from close analysis of style, to have each general judgment rooted in that kind of illustration. This is the essential guide to knowing just *what* any passage really says. One gets closer to its character by watching individual words and images, listening for changes of stress, noting omissions as well as commissions.

The second approach, I said a long way back, is through examining larger elements in a work than "rhetorical" analysis implies (although this approach too has to be based on close reading)—through overall structural qualities and larger recurrences of various kinds, through myth, symbol, thematic pattern.

One of the most interesting discoveries in work of this type is that social scientists and literary critics can be very close to each other. Approaching this kind of analysis from different ends, they can not only reach similar conclusions but are likely to use similar illustrations and emphases en route. There is an essay in *Mass Culture* by two sociologists—"How to Read 'Li'l Abner' Intelligently" by Arthur J. Broadbeck and David M. White—which for a start could be compared with essays on similar subjects by literary critics. So might several essays by the American sociologist David Riesman. Some of the earliest work done by an Englishman—still among the most interesting—is George Orwell's (see his essay on "Boy's Weeklies"). Kingsley Amis' recent book on Ian Fleming is, so far as I know, a unique instance of a thoroughly ambivalent work in the field—part critically perceptive, part nervously evasive of its own implications.

But the crucial importance of literature to a student of society lies (to come back to where we started) in great works of literature. Although popular art and mass art may tell much about a society, great art

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tells infinitely more. In fact, the statement is tautologous. One of the ways of defining great art is to call it that art that transcends the conditions that gave it birth and so penetrates further into human experience, sees more, than those conditions promised.

The better the art, the better the witness realized; and this is a judgment of quality, not quantity. Zola is not as great an artist as Stendhal, although he went to much greater pains to get his social detail correct and full to overflowing.

That quality of perception, which we referred to earlier in quoting Auden's essay on *The American Scene,* is the crux of the matter: a capacity to see not only individual instances but deeper and more long-term movements below the surface detail; an ability to unite dissimilars, to reveal a pattern out of a mass and a mess, like a magnet placed into iron filings. This quality is presumably the basis of any significant hypothesis in any discipline and so is shared by creative scientists; in no discipline is it a matter of simple aggregation.

Behind the writing and the reading of all good literature lie a number of extraordinary assumptions. The literary student takes them for granted, but perhaps should consider them more and remind himself of their extraordinariness. The student of society can certainly benefit by looking at them. Why *should* men try to "re-create" their personal and social world? Why should they—as well as analyzing it, probing it, generalizing about it, taking it to pieces, finding its component parts—have felt moved to "make it again"?

One reason seems to be that men do it not so as to effect anything but, so to speak, for its own sake; because they feel wonder and awe about the nature and terms of their life; and because they feel amusement, irony and pride at man's attempts to cope.

Another reason seems to be the wish to be in touch with others. Literature implies an audience: perhaps not a very large audience, perhaps an audience that is "fit though few"—but always an audience. It assumes the possibility and the worthwhileness of communication with other human beings. Without having to say so explicitly, it says at the back of its mind: we are not alone; although we may be "poor, bare, forked animals," we can try and can hope to get in touch. And this, although it may not at first glance seem to have much to tell the student of society, has a significance for him that he would neglect to his enormous cost.

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Electronic Music and Musical Newness

MEL POWELL

Electronic music relates to the musical past and future in whichever way composers and listeners choose to relate it. In one weighty sense its situation with respect to the history of musical thought is that of an extremely obvious corollary: a logical and natural development within a particular genre of sound-making resources. This genre is the nonvocal, the vast world of soniferous artifacts including anything and everything employed in the projection of musical sounds other than the human voice itself. Under so fundamental a mode of classification there are no distinctions to be drawn between the strung rattle of the paleolithic hunter, the *kinnor* supposedly played by Jubal, the ancient Chinese *kuan,* the medieval *trumscheit,* the Renaissance shawm, the baroque *viola pomposa,* any of the more recent, more familiar instruments, or the transducer and playback systems that convert output of a high-speed digital computer to sounding forms.

With the human voice thus ranked uniquely (everything else being defined as artificial machinery), the point of view sets forth what its proponents feel is the strongest and simplest measure of naturalness in musical sound production. Probably it is, but in any case electronic music is not simply a matter of the particular sound-making machinery involved. The machinery is indeed crucial, but mainly in that it causes composing itself to become, directly, literally, sound making.

Just this circumstance characterizes the newness inherent in electronic music. For it brings about a relationship of composer to listener that is singularly straightforward, that is, devoid of the "interpretative conversion process" that constitutes the performing artist's performance. Although it is of primary importance to note that the various methods and technologies in electronic music make possible (theoretically) the synthesis of any sound whatsoever, not even the notoriety of unfamiliar sounds seems quite so notorious as the irony that has endowed composers and listeners with a direct communication system in a century when communication between them has been, and remains, hardly discernible at all.

Among other and perhaps less conspicuous peculiarities that arise, there is the composer's sudden shift away from traditional encoding in written symbologies, and for that matter, there is the music's dissociation from visual miscellany in general. This necessarily defines new roles for music analysts and for other music theorists and scholars. Especially in the United States, where the domain of serious new music (electronic or not) is now enclosed almost entirely within small areas of the academic world, the absence of notational forms appears to be a potentially grave deprivation. Certainly in the seminar it often turns out that the idea of hearing what there is to hear in music simply by astute listening betokens, despite the idea's elementary virtue, a serious disruption of established routines. The art of music analysis, for instance, has traditionally been developed as a formal exercise in describing the ear's knowledge on the basis of the eye's information, and so elaborate and venerable a pursuit is not easily put aside. In other areas, too, basic procedures remain notation-oriented, and of course music scholarship in general, like so many other varieties of scholarship, tends

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to flourish most naturally, and on occasion exclusively, in the form of written documents about written documents. Hence the field of electronic music is far from perfectly attuned to the needs of many standard academic ventures.

This is not to say that there is a shortage of monographs and lectures devoted to the subject. Nor is it possible to overlook the growing population of off-campus advocates and gainsayers. But from the many discussions that now take place both within and outside the spheres of the variously initiated, it can be inferred that in the expression "electronic music" it is the adjective that is receiving the principal emphasis. Largely for that reason it is not often easy to distinguish between a particular interest in the field and a general curiosity about gadgets. The word "electronic," to be sure, is utterly alluring nowadays, the kind of virtuoso word that takes and holds the attention, arranges and deranges the imagination, inspirits, discomfits, reverberates, charms, mystifies. Such grand seductiveness apparently belies Huizinga's observation of some thirty years ago: "For us, flooded as we are by the stream of words in print and on the air, the word is losing more and more of what is basically still a magic effect. In a more primeval society the word falls on a virgin soil thirsting after fecundity, it convinces and commands, it banishes and binds, in short, it effectuates." If that is truly the case, then, since the effect of the word "electronic" is, at the very least, magical, we have at hand an unexpected manifestation of our society's pristine innocence.

Presumably it is not out of the question to ascribe to *electronophilia* (or *-phobia,* as the case may be) a certain innocence, but in seeking to determine what is and what is not significantly new in music an entirely different mental outlook is required. Innocence here amounts to ignorance. For, as it happens, although a familiar rule of combination suggests that gadgets and revolutions go hand in hand, nothing of the sort occurs in the world of musical composition. Instead there is the fundamental fact that a new music appears only when an original composer appears. It should therefore be easy to understand, although it is not widely understood, that with respect to musical structures as such, the mechanisms of, say, oscillators or band-pass filters are ultimately neither more nor less strategic than are the mechanisms of, say, clarinets or mutes. The surface of music is indeed the sound of music, but the innovations and marvels of an innovational marvelous composition are what they are with merely incidental reference to that surface. This important point eludes many laymen and perhaps many musicians as well. Yet for the composer there is no conceptual difficulty in regarding the nature and quality of any particular composition as essentially independent of the particular mode of sound production involved in its realization. Consider a Mozart symphony played at the piano, and possibly the idea is clarified. Or consider the boundless innovations of Gesualdo's work as opposed to the ancientness of its sounding medium, that is, a few human voices.

The heart of the matter, then, is that the history of music is not a history of musical instruments, but rather the much richer history that outlines a sequence of composers' boredoms: the chronicle of just which musical formulations become stale in the opinion of whom at what time. Granting electronic music its novel franchise, the overriding criteria thus remain as they were. What remains true, therefore, is that a genuine newness in musical thought is one thing, and whatever that thing may be, it is clearly something other than any mere newness of acoustical hardware. If the time is scarcely yet ripe to appraise the achievements of that handful of composers who have produced serious works in electronic music, or even to survey the prospects for the young art, surely any moment is an appropriate moment to recall the controlling distinction between the nature of ideas and the nature of vehicles for ideas.

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Epitaph

LOREN EISELEY

I shall be a part of all Octobers
I shall be part of sleet and driving rain,
I shall scurry with dead leaves on pavements,
I shall be dust and rise from dust again.

Stranger, be not afraid because you follow
Fast on my heels yet know the light of day.
The earth takes back the garment that it lent us
To clothe the hedgehog or the bright blue jay.

All this I was before the living trapped me
And hurled me from deep night into the sun.
I have gone home because a snowstorm called me.
Say to my love there is no other one.

Say to my love I am somehow dispersèd
Into the snake that haunts this hollow bone.
I sleep his coiling sleep, but tell her also
How many times we've tilted this death stone.

✪ LOREN EISELEY is a naturalist and historian of science, well known for his studies of the Darwinian circle and its forerunners.

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Masscomm as Educator

W. H. FERRY

Mass communications means television, the press, paperbacks, radio, comic books, the great circulation magazines, and their accomplices and adjuncts: boards of directors, editors, public relations mechanics, advertisers and writers. In including the last category I invoke the Nuremberg doctrine: great collective sins, as well as great collective achievements, are the products of individuals. Thus the discussion must take in the scribblers and sergeants of the trades as well as the Napoleons and Metternichs.

Responsibility means the state of being responsible, that for which one is answerable—a duty or trust. Cultural and social signifies those areas of the common life somehow apart from the political realm.

Phrases like "notable exception" should be salted through the following pages. I shall not attempt a weighing-up of mass communications, fair and balanced to the last gram. My thumb is firmly on one side of the scales. I shall be talking about macrocause and macroeffect. I know about the occasional brilliant and illuminating broadcast, article, report, picture essay, and pay my respects to them herewith. They will be given no more attention in this paper. The acute sense of self-appreciation developed by mass communications tells us a great deal about them, for one thing. For another, it scarcely seems required to pay homage to an institution for doing what is expected of it.

I wish also to acknowledge that the common run of breaking news is probably as well reported these days as at any time. I am aware of mass communications' need to make a living, its concern with "events," the impact of instantaneous electronic reporting. I know that mass communications are both cause and effect, acted upon as well as acting. There are titans in the field and I herewith pay them my respects also. My comments are not directed at the conscientious and striving few but at the thoughtless and irresponsible many. I am not unsympathetic to the variety and intensity of the demands on mass communications, and intend to add to them.

In the following pages I shall use the word masscomm, not because I like such ugly neologisms but to spare you the repetition of the equally dreary phrase, mass communications.

I assume, as I suppose do most of my readers, that mass communications have social and cultural responsibilities. A good many theories of responsibility have in fact been elaborated, by Walter Lippmann, by my associate Robert M. Hutchins, Father John Courtney Murray, the late Alexander Meiklejohn, and others. All are based chiefly on two grounds: the singular position accorded mass communications by the First Amendment, and the indispensability of criticism and guidance and fresh ideas to a democratic society.

The notion, of course, is that the people are sovereign, and need a clear stream of information and conflict of opinion to order the community. In 1947 a Commission on Freedom of the Press presented a Report that, in its five main requirements, provides a theory of responsibility. The five requirements are:

1. The press must give a truthful, comprehensive and intelligent account of the day's events in a context that gives them meaning.
2. The press must provide a forum for the exchange of comment and criticism.
3. The press must project a representative picture of the constituent groups in the society.

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4. The press must present and clarify the goals and values of the society.
5. The press must provide full access to the day's intelligence.

Although specifically addressed to newspapers, these requirements can readily be modified into a general theory applicable to the rest of mass communications. But that it is not commonly accepted is evidenced by the reception by the press of the Report. It was vilified, misrepresented and ignored. The Commission's mild recommendation that a group of private citizens be organized to appraise the doings of the press and make statements from time to time on its misadventures and accomplishments met with virtually unanimous denunciation. There was a great deal of identifying of the press with what its proprietors wanted to do, which seemed to them identical with their responsibilities. The Commission's Report also provided the occasion for a campaign of unrelieved self-admiration. Today's counterpart is television's crankiness toward critics and its relentless self-glorification when it is suggested that it might improve its output.

So much for a commonly accepted theory of responsibility. I suspect that there are deep historical reasons for masscomm's nonacceptance of well-defined obligations. But I think the main reason is that masscomm is preoccupied with another responsibility, that of making money. Masscomm argues that it cannot fulfill social and cultural responsibilities by going broke. Fair enough: no one expects the extreme sacrifice. This is not really the issue. The issue is whether masscomm has made the precondition of profits the entire reason for its existence, and its only basic responsibility. This is a different general theory, so to speak, and seems to me to be close to the cuticle. The matter may be stated slightly differently. The United States, for better or worse, is a money-seeking culture. Masscomm is a money-seeker like any other institution. Thus, it argues, it ought to be measured by the amount of money it makes, not by archaic ideas about responsibility to the community.

I propose that masscomm begin to take itself more seriously. The balance of this paper suggests that masscomm bears social and cultural responsibilities of much greater weight than it has been willing to shoulder. Whether it can undertake such responsibilities and still remain solvent is the question. Perhaps we could find out if masscomm sought not to make more each year than the year before and concentrated instead on looking to its fundamental obligations. As a veteran member of the League of Village Scolds I know that it is not especially rewarding to exhort particular men to reform themselves. And so these remarks must be considered less a collection of remonstrances to those now running masscomm than a general prayer that masscomm as an institution may rouse itself somehow to the performance of duties long and dangerously neglected.

Few spokesmen in masscomm would assert a doctrine of social and cultural nonresponsibility. Nor would many of them deny that in some way and to some degree masscomm has shaped American institutions. Scott Buchanan says that the First Amendment is the source of all of the duties, privileges and immunities of education, although the word itself does not occur in the Amendment or, for that matter, anywhere else in the Constitution. Perhaps masscomm recognizes, whether unconsciously or not, that its wide warrant is obtained in the same way and that essentially its task is education. This, it will be perceived, is a one-word summary of the five requirements of the Commission on the Freedom of the Press.

My view is that masscomm's social and cultural responsibilities are those of the largest and probably most influential educational system any society has known. The relation is teacher and taught. I do not suggest that masscomm is like a university. The differences are evident. Nor can one suggest that everything would be fine if masscomm merely modeled itself on the university, which itself is having grave difficulties about its functions.

And it might well be maintained that education also would take on irresponsible aspects if it depended on paying custom-

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ers, free to come and go, buy or not buy, look or not look. But this is a heavily debatable proposition, and in any case my topic is masscomm and not the machines of formal learning for the young.

Aristotle provides the point: "Men by nature desire to know." They do not cease desiring to know at sixteen or twenty-one or twenty-five. Learning proceeds throughout life, willy-nilly. The means of learning change and become informal. What is learned changes. For most people masscomm provides the means of their continuing education, for good or ill; and masscomm's choice of topics and emphasis decides, for most people, what is learned. It is in these respects that I confer on masscomm the accolade and obligations of educator.

I cannot think of a nicer compliment than to call someone a teacher. But I discover that masscomm does not much care for the title. Perhaps that is because masscomm realizes it must be given on every front low marks as an educator. It does not fully inform, it mystifies as much as clarifies, it seldom lifts up. I had better proceed to examples. The situation of American Negroes has been a disgrace from Reconstruction on, a running sore on the national body. It would be a festering cancer to this day had the issue been left to masscomm. A few courageous Negroes and whites taught in three years a public lesson that was never in masscomm's curriculum, and the Negro now has at least a glimmering chance to break out of latter-day slavery. For generations two-thirds of our Negro population has lived in poverty or deprivation. Unemployment has been twice or more that of whites. Who knew these things?

It is commonly acknowledged now that the pot boiled over in Los Angeles last summer because of frustration and resentment and indignity stored up too long. How much were Californians told about the sputtering fuse? Even the best-intentioned of them were aware of little or nothing. Bishop Kennedy, the liberal and kindly Methodist leader of southern California, apologized publicly for his ignorance. "I didn't know," he said, "that this was the way they lived."

These are significant and not isolated instances of masscomm's failure in the first task of education, to inform and clarify. This sedulous nonconcern for the rights and dignity of Negroes, to which I shall return, may be contrasted with the yawping that ensues whenever a question is raised that seems to infringe on masscomm's rights and dignity. Freedom of the press was stridently invoked not long ago to justify masscomm's desire to underpay newsboys. Its role as conscience of the community is played with passion when masscomm's institutional interests are involved. The conscience slumbers when the interests are those of the unlucky and helpless.

Masscomm's role as defender of the strong against the weak is illustrated by the current concern with poverty. Americans found out about poverty when two or three angry young men pulled back a blanket of ignorance and neglect and uncovered some forty million Americans living in degradation and need. The invisible poor discovered by Michael Harrington were invisible because masscomm didn't care. Masscomm was busy elsewhere, counting profits, celebrating the status quo, selling junk. That mascomm even missed a bet with its constituency is evidenced by the current popularity of the war on poverty.

Masscomm's delight in the shoddy, the tasteless, the mind-dulling, the useless, is well established. It is a direct consequence of masscomm's allegiance to organized rapacity. Qualms of conscience about the effects of dishonest advertising or spirit-punishing presentations disappear like morning mist in the glow of a comfortable advertising contract. Equally well-established is masscomm's tendency toward submerging important issues in a sea of pointlessness, as for example when an important public decision may seem to be linked to a participant's fondness for bow ties or popcorn. These practices are said by some to be an inevitable concomitant of affluence and literacy, not very important, to be seen as bubbly sidewaters to the strong central currents of American life. I do not agree.

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These practices amount to a policy of trivialization, and trivialization comes as close as any other bit of testimony to the heart of the indictment.

The general theory of responsibility stated earlier does not require that masscomm treat only important public matters, and that it ignore the immense carnival of contemporary life, its sideshows and heroes, achievements and banalities. Offerings for sale and entertainment and diversion are a part, but they are not all. The general theory requires only that fundamental duties not be obscured or neglected in favor of the trivial. It is the context and balance that is destroyed by the policy of trivialization.

The pristine vision of the First Amendment is that of an untrammeled press, somehow standing apart from government and society, reining in excesses, raising standards, asking irreverent questions, cutting down villains and villainy, praising the virtuous. It is to be the master warts-and-all portraitist of the American scene.

But masscomm does not portray what is there. It does not stand apart. It has signed up with the Yankees, so to speak—with the rich and powerful, with the government, with the successful and prestigious. Signing-up means joining the team, contracting to safeguard its interests and to help win its games. It would not be easy for masscomm to find its own ground, to achieve the separateness that seems to me its first requirement. Now this pledge of allegiance to the privileged is a familiar enough count in the indictment of masscomm. But the supporting data are not merely those usually presented—the grotesqueries of advertising, the unwillingness to print the story about the wife of the department store owner, the unending concern with the Beatles and Dick and Elizabeth.

The prime consequence of signing up is the stupefaction and brutalizing of the nation. All the dirty garbage in our social and cultural order cannot be dropped at masscomm's door, to be sure. But I agree with the Right Honorable W. F. Deedes, M. P., who recently said of television, "It has within its power to decide what kind of people we become. Nothing less." I would only make the Right Honorable's statement retroactive and extend it to the rest of masscomm.

It seems to me beyond argument that masscomm is a chief contributor, although not the only one, to the social and cultural malaise lying on us all. This is so because masscomm is a major beneficiary of it. Masscomm can make more money not meeting its social and cultural responsibilities than by doing so. American culture is marked by the compulsive consumption of trash, and by the ennobling of practices such as intentional obsolescence. Masscomm enthusiastically endorses such activities. Our environment turns into a visual junkyard, our rivers stink, and masscomm declares that it is all regrettable but commerce must be served. Strangers might conclude from masscomm that we are conducting a civilization virtually without blemish, full of grinning families playing games in marzipan neighborhoods, with no problems or future except that of assuring ourselves more grins and fun.

Nor is it accident—to move to another example—that violence, delinquency and crime have mounted as this country has increased its reliance on the weapons of universal terror. We cannot really expect that counsels of reconciliation and reason will prevail in our domestic affairs when we resort to war abroad with all the lethal paraphernalia provided by technology. The scope of this paper does not take me into national policy in Vietnam and elsewhere. What I wish to remark is masscomm's posture with respect to these policies and events and its effects on the country. Americans are killing and maiming and burning and torturing in Vietnam. We may even get into a nuclear war, an eventuality that masscomm appears to believe may sometime be necessary, although of course unfortunate. These present and potential activities are, according to masscomm, a great patriotic exercise. Masscomm, putative bastion of our liberty, does not protest as we turn into a garrison state. Far from inquiring seriously into the demoralizing results for the nation of de-

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pendence on militarism, terror and overwhelming might, masscomm applauds. "My country right or wrong" is the advice most often given to us in these dangerous days by editorial writers. Quite apart from the question of peace and coexistence, which is our ultimate destiny if it is not to be that of a cinder, the issue is what happens to a civilization when its darkest instincts are constantly being stimulated, and when that stimulus is applied day after day. I think that what happens is that a civilization turns sour, and becomes insensitive and sanctions terror and torture, and forgets its moral obligation.

Consider for a moment the instructive lesson of Germany twenty-five years ago, if one may do so without implying that the United States is tottering on the brink of nazism. The worst thing that Hitler did to his country was to brutalize it. He ruined the national conscience. With the glad assistance of a signed-up mass-communications system, he debauched the minds of two generations. Parading the spectre of Communism fearsomely up and down his country, he turned paranoia into patriotism. The people were being made ready for the great orgy, always with masscomm as the indispensable instrument.

In what ways are the situations alike, in what ways different? There is the same enemy, Communism. There is the same concentration of industrial-military might. There are the same dreadful paradoxes dressed in Newspeak, calling acts of war acts of peace. The invasion of other countries is justified by appeals to national honor and security. Hitler had a final solution and used it on six million human beings. We have a final solution ready if all else fails, nuclear war. The difference in scale is impressive. It took Hitler many years, many people, many pits, gallows and ovens to achieve his final solution. With far fewer helping hands and in one-thousandth the time we can exterminate fifty times as many people.

I do not suggest that it is the duty of masscomm to agree either with my analysis of where we stand in the race between genocide and humanity, or with my remedies. Its obligation is far greater: to remain disengaged from the apparatus, to criticize its aims and its claims, to let the citizenry know what is happening to them as they lean more and more on muscle and less and less on mind; and, above all, to stay out of the cheering section. The press was guaranteed its freedom almost two hundred years ago so that it could keep an unwinking eye on government. The irony today is the degree to which it has become the apparatus's main support. Whatever sanity is entering United States policies in the Far East is coming via teach-ins and demonstrations, not via masscomm. I believe that our chance of becoming involved in nuclear war is directly proportionate to the shared warmth of the masscomm-industrial-military-government axis. The heat is already intense.

Self-righteousness is a wonderfully effective emotion for brutalizing a nation, as Hitler realized, and there is no agent superior to masscomm for filling the reservoir of national self-righteousness. The apparatus, abetted by masscomm, needs to be able to call on two ingredients. First, great economic and military strength, preferably massive enough to be a source of embarrassment and guilt. These sensations cry out to be transmuted into something worthy, and masscomm obliges by making our overwhelming capacity for violence appear to be the gift of a far-seeing Providence. Thus we become the policeman of the world, with hosannas from masscomm for our manliness.

Second, we need an enemy—not just any old enemy, but one who is sinister, conspiring, terroristic, atheistic, power-hungry, monolithic, antihuman and un-human. We possess this ingredient, too. How much this enemy is a genuine historical development and how much a United States manufacture is something that history will have to decide. My view is that the enemy is in many respects a product of masscomm, especially in those attributes that make him seem so much smarter, stronger, less human and more clever than Americans are. It seems to me an open question whether the apparatus and masscomm have gone to

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all the trouble of helping to fabricate such a terrible and terrifying enemy only to learn that they somehow have got hold of the wrong fellow. We are slowly beginning to see that nationalism and hunger are the true rascals. The chronic revolution that we shall all spend the rest of our lives enduring and trying to understand is no more a product of Communism than a toothache is a product of the dentist's chair, or a neurosis the infliction of the psychoanalyst's couch.

But this is not what we learn from masscomm. Editors and publishers and broadcasters notoriously like uncomplicated views. Communism and the Communists are such satisfactory villain material, too, stubborn, eccentric, closemouthed, suspicious. This is not to say that there are no genuine clashes of interest and principle, or that Communists are particularly comfortable people to have around, either in the neighborhood or in the world. It is not to say either that masscomm in this country alone is guilty of enemy-fabricating, for we know its foreign counterparts are every bit as adept in the art. It is indeed one of the curiosities of our time that it is so hard to see much difference between controlled and uncontrolled masscomm in this respect.

We are here close to the crux of the matter. A signed-up system of masscomm is bound to present an unreal view of the world. This has consequences ranging from the merely mortifying to the possibly lethal. Thus we have got ourselves into the horrible box of identifying all liberation movements with Communism, thus raising the status of Communists and lowering our own. And the partial views of Communists as incorrigible adventurers and military expansionists may lead us into the final big war.

I wish to expand at this point on the earlier example of white attitudes toward Negroes, because my statement about the potentialities of evil in half views and unrealities may seem extreme. Before Rosa Parks performed the momentous act of sitting in the wrong part of the Birmingham bus, what was the picture of the Negro nation presented to us by masscomm? Through its cloudy lens in the South we saw Negroes struggling patiently through courts to get their children into decent schools, indignant, perhaps even irritated at the delays occasioned by the need to give the White South time to accommodate. Once in a while we picked up the odd bit of gossip about the habitual injustice to Negroes in the criminal courts and their inability to vote in a good many places. According to masscomm, Southern Negroes were being treated well, in the Dixie version of that term, and were responding by forbearance and understanding. Mass communications portrayed a colored minority waking slowly to the possibility that it had some rights, including a few they had always known to be a white monopoly, and walking softly and patiently toward the Promised Land. Except for a troublemaking and querulous few, masscomm intimated, this minority was quite ready to forego voting, opportunity, schooling, dignity until the white nation got used to the idea and became willing piece by stubborn piece to bestow these bounties.

The Northern portrait was even more illusory and vicious. Masscomm rejoiced that Jim Crow was not official doctrine in Detroit, Harlem, Chicago, Rochester, Philadelphia. They neglected to say that it was standard practice. There was, to be sure, the occasional flare of trouble in these precincts, duly reported by masscomm and as duly attributed to Communists, Muslims or chronic malcontents. Once again masscomm produced the wrong enemy. Inattentive authorities, greedy landlords, cybernation, bad education, all the complex causes of Negro misery that make up the real enemy used to be mentioned by masscomm only once in a while. The favorite culprits of masscomm are, in the race situation as in all others, still Communists or agitators.

So masscomm was able to assure us that Northern Negroes were aware of how much better off they were than their Dixie cousins. The white nation did not really need to be concerned about ghettos, rats in bedrooms, the daily indignity of Negro life,

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because Negroes were used to it, grateful on the whole for the droppings from the white table. Above all, masscomm assured us, Negroes were accustomed to the thought that it would take generations of thankful obedience to white overlordship to win their way to equal justice and opportunity. If Northern Negroes were not happy with their lot, they were not unhappy enough to say anything loud and impolite about it either. We had to get our stereotype of the Negro some place, and masscomm was glad to provide the infamous caricature of him as gospel-hymning, crap-shooting, indolent, carefree, sex-powerful, and loving the squalor he lived in.

This, I think, is not an unfair outline of the general picture of the American Negro presented by mass communications in those pre-Parks, pre-S.N.C.C., pre-riot years. It was not only a grossly unreal and ignorant picture—masscomm did not have Bishop Kennedy's excuse of not knowing—it betrayed irresponsibility toward millions of fellow citizens, and unconcern about a dirty condition by which the world would judge this country, even as South Africa is judged.

Masscomm felt free to ignore and misrepresent the real plight of the Negro, North and South, because it is white, rich and privileged, because of sheer delinquency, and because masscomm believes its audience dislikes disagreeable realities. So instead it offered Potemkin villages and spun-sugar homilies about the success of the American Dream.

Here we encounter masscomm's first and last line of defense: We give the customers what they want. Assuming as I do that masscomm's responsibility is primarily that of continuing liberal education, I do not take the defense seriously. Liberal education is education befitting a free man, and tending to make him more competent in the exercise of his responsibilities. Liberal education aims at improving intelligence and sharpening perceptions of good and bad. There is no such thing as education, liberal or otherwise, based on lowest common denominators, except the education of slaves and vassals. Anyone acquainted with the literature of masscomm knows that the dispute about the validity of its appeal to democratic dogma is endless; the apologists for masscomm tirelessly intone the obligation to give the customer what he wants. The equating of audience ratings and circulation figures with political principles seems to me defective. But I do not propose to add much to this ancient rhubarb here, except to indicate a significant paradox.

The democratic thesis is that of consent, participation and improvement. Citizens agree to the basic structure and direction of the nation. They take part directly and indirectly in its governance, and have no choice except to do so. The commonwealth is supposed to move onward and upward as a result.

But if masscomm's customers decide what they want to see, hear and read, and if the customers appear to want mainly piffle, what happens to their competence for self-government? What if the tendency of masscomm is to make difficult and in some cases impossible the conditions for self-government? David Williams says in his *Not in the Public Interest,* "An informed public opinion is the essential element in a country which claims to be democratic." But it is not only information about yesterday's Congress and traffic accidents, but information about those crucial developments now seldom reaching the surface of masscomm. I acknowledge that the country is somehow limping onward, despite the failures of masscomm and other great national institutions. But "We're getting by" is not a satisfactory answer either, for the ultimate questions are whether self-government is surviving or is being turned over to elites and machines; and whether the criterion of consistent improvement is being met.

There is a variation in this answer of masscomm. It says that it does not create social emptiness and cultural chaos, but merely reports what it finds. Masscomm portrays itself as the efficient conduit of social intelligence. "Too bad," it says, "that so much sludge passes through the

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conduit." Also, the answer continues, it is not the fault of masscomm that people prefer fantasy to fact and—this is always asserted with great emphasis—not masscomm's problem, but theirs, if they prefer entertainment to information.

Masscomm's great delusion, which is self-delusion, appears at this point. It deludes itself that because other institutions, the educational apparatus and the family among them, also mould the community, masscomm does not really have any decisive effect on social conditions and cultural development. This is why it can, in all innocence, look under every bed but its own in a search for the explanation of crime, vandalism, race riots, the rape of rivers and forests, and the bloodthirsty campaigns of the right wing.

Another virulent aspect of this self-delusion is masscomm's stated conviction that it can meet the full range of its social and cultural responsibilities in spite of its allegiance to the highly favored sectors of the community. It is like trying to bunt toward third while standing on your head. Masscomm is a fully paid-up member of the American palatinate, the confederation of the powerful and privileged. Its loyalty and interest runs to institutions, not to people. This signifies the bankruptcy of the educational function, where people are the essence of the teacher-and-taught transaction. Self-delusion persuades masscomm that it is meeting its obligations when it is making money, and that its critics are wrong in some sort of ratio to the margin of profit.

The best one can conclude, and also the worst, is that masscomm does not know any better, and that it assumes it is doing as well as anyone has a right to expect in functioning as the shield and buckler of status quo.

The date of the following quotation is 1922; the subject is radio: "It is inconceivable that we should allow so great a possibility for service, for news, for entertainment, for education, and for vital commercial purposes to be drowned in advertising chatter." The speaker was Secretary of Commerce Herbert Hoover.

I would moderate the severity of my remarks if some motion toward improvement could be discerned. I see little or none. After every social calamity—an American war against Asians, the race eruption, the escalation of crime—acres of print and hours of network time are allotted to explanation and analysis. For such performance, which becomes a little better as calamity becomes more frequent, we owe brief thanks. But masscomm has not learned yet the simple lesson that the time to deal with catastrophe is before it happens, and the companion lesson that it here has very great responsibilities indeed. In this anticipatory role its performance ranges from nil to silly. The coverage of the uprising of the California students was a masscomm scandal. The problem at Berkeley had been forming for years. President Clark Kerr described the causes in a celebrated book months before the event. From the earliest glimmerings of difficulty, masscomm misunderstood and misstated what was going on. Thus must gratitude for the good post mortem be balanced with condemnation for bad antemortem performance.

It must be asked, therefore, where else one might look for the positive assumption of social and cultural responsibility, that is, for the shifting to higher levels of taste and sensibility and the general welfare. One would hope first that as more people are better educated, the result would be a general elevation. The rising trade in concerts, good books and records, museums and discussion groups is adduced as a fair wind already blowing from this quarter.

One would hope for the continuation of demonstrations, which by now are accepted as the free press of the movement to win justice for Negroes, to banish impersonality from the university and the corporation, and to spread the word that peace, not violence, is the only possible destiny for a nuclear-knowing world.

One would hope for the calling of a Constitutional Convention, to get out into the open the great tangle of eighteenth-century ideals and twentieth-century conditions that produces the fundamental perplexities of our time. A Constitutional

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Convention would have to appraise masscomm and determine its fitness to continue under present immunities and privileges.

One would hope, without any good reason for doing so, that there might be a wholesale reform in the great Corporate Community, with priorities changed, in the sonorous words of the Administration, from "the quantity of our goods [to the] quality of our lives."

I can be more specific. Perhaps masscomm needs some tax encouragement to devote itself more strictly to its obligations. We subsidize shipping and the oil industry liberally, and surely a free and independent press is as valuable a national asset as agriculture, the object of our most princely benefactions. Tax incentives should not be offered for the enlargement of profits however, but to make it possible for masscomm to stick to its prime task, which means getting out of the distracting sidelines that, like many other profit-chasing corporations, it now engages in: baseball teams, art vending, electronics manufacturing, record-making and the like.

Perhaps there is a way, by use of the taxing power, to divorce the entertainment and news-and-education functions of masscomm. In the thirties we managed to divorce investment banking and banking for good reasons of public policy; this might be a useful model.

It would still be possible to create the private committee recommended in 1948 for surveying the operations of masscomm to report on its departures from duty and to praise efforts at self-improvement.

Foundations could—I do not say would—underwrite long-term efforts to raise masscomm's general level by force of good example. They could also underwrite educational television for the long term, so that this promising innovation would not have to spend most of its time begging.

Perhaps no more utopian than these suggestions is the notion that the managers of masscomm might themselves, in the light of the enormous and increasing difficulties confronting the country, undertake a regeneration. They are after all not malevolent or less patriotic and concerned about the fate of the commonwealth then anyone else. They are stuck in a system from which they could, given massive will, unstick themselves.

Yet these therapies are probably too unreal or drastic to be considered, and we shall have mainly to look to government, the resort when all else fails. Alexander Meiklejohn, one of this country's mightiest educators, was perhaps the most devoted friend that masscomm has ever had. Throughout his ninety-odd years he battled relentlessly for an absolute reading of the First Amendment. Precisely because he was an educator, he saw in an unfettered system of mass communications the means of carrying out the social and cultural responsibilities that could be met by no other institution. He saw mass communications as the necessary adjunct to his dream of lifelong liberal education. But just before he died last year Mr. Meiklejohn perceived that the theory was failing, or had failed. So he proposed in an unpublished paper for the Center for the Study of Democratic Institutions that his cherished First Amendment be revised by adding the words,

> In view of the intellectual and cultural responsibilities laid upon the citizens of a free society by the political institutions of self-government, the Congress, acting in cooperation with the several states and with non-governmental organizations serving the same general purpose, shall have power to provide for the intellectual and cultural education of all of the citizens of the United States.

I have no idea whether positive government of the kind foreshadowed by this suggestion would work. What is significant to me in this proposal is the inference that the private motors we have counted on to propel us constantly into a finer community are virtually out of gas.

It will be protested that I ask too much. The answer is that my demands are those made of liberal education wherever it is being conducted. It will be said that formal education has never been able fully to do what I wish masscomm to do. The answer is that this is no excuse for not trying. It will be complained that all of the

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foregoing is a statement of personal predilections as to the proper course of society. I shall say that this is true, and grant further that I have a different opinion from that of masscomm of Americans and their aspirations. At the same time I assert that I have been expressing a general view, although admittedly one not often stated. I believe there is in this nation a rising awareness of the tendency toward demoralization of the common life; a growing appreciation that citizenship is more important than consumership; an increasing fear that the human being will be lost beneath the lumber of technology and bureaucracy; a quickening guilt about the friendless, the impoverished, the victims of wholesale injustice; a widening comprehension that getting richer does not mean getting better; an impatience with half-truths and semirealities; and I believe that I speak in some way for this forming consensus. If mass communications can catch a glimpse of this other yearning America there is a chance, perhaps a very slight one, that they may yet share in the vision of an active and moral democratic order in these United States and in the world.

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Television: Window on Culture or Reflection in the Glass?

AUBREY SINGER

Before I begin, let me explain where I stand. I am not an academic. I am a practicing television executive producer and manager. I believe with Leo Rosten that the media, especially television, are enterprises, not I. Q. tests. They feed on inventiveness, not analytic discipline. They require creative skills and nonstandardized competences. It is from this standpoint that I write.

Television is something by our times, out of our times, for our times. It reflects the virtues and faults of our times.

Its electronic principles were conceived by the prophets of technology about the same time that practical radio was being demonstrated, that Einstein was laying the basis for the exploitation of matter, that concepts of anthropology were shifting to concepts of sociology.

Television was conceived at the end of the century when man's curiosity was optimistic, charitable and untarnished, when man still believed in God, in man, in laissez-faire economy and in the rigidity and essential firmness of the world around him. Although this world was changing with increasing pace, Marlowe's lovely lines written in the last half of the sixteenth century fit the vision of man and the ambitious aspirations of the times.

Nature that fram'd us of four elements,
Warring within our breasts for regiment,
Doth teach us all to have aspiring minds:
Our souls, whose faculties can comprehend
The wondrous architecture of the world:
And measure every wand'ring planet's course,
Still climbing after knowledge infinite,
And always moving as the restless spheres,
Will us to wear ourselves and never rest,
Until we reach the ripest fruit of all,
That perfect bliss and sole felicity,
The sweet fruition of an earthly crown.

There it is, the reconciliation with environment to reach felicity through knowledge.

But in the fifty years from the turn of the century, in the fifty years that television has grown from an idea to fulfilled reality, man has changed and his ideas have changed his environment. Earth, air, fire and water lost their place as observed and simple absolutes two hundred years ago. It has taken this time for a new idea, the equivalence of space, time, energy and mass, to become their substitute.

Those old four fundamental elements, those archetypes of our environment, today are held in low respect. Earth is consumed for minerals, moved by the mountain, shaped, bored into, synthesized. Air is flown over and above, liquified, solidified, split into constituent gases; its climate is altered, its heat and cold ignored. Fire is made small before the power of the nucleus: man can imitate the sun. Aqualung, bathyscaphes and permeable membranes are letting us return to our beginnings, to the sea that was the womb of life.

In fifty years man has not merely come to control environment at will. His familiarity and dominance now hold it in contempt. After all, when an astronaut can fly through space, when a picture can be transmitted around a planet or from another planet, when a jet can fly from London to New York in a few hours (and all this was developed within the last two decades), it

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is not surprising that man should have suffered an implosion of his horizons. Our personal and terrestrial worlds are no longer large enough—the immediate world has given way to the desperately desired imminence of the future world. "Give us this day our glimpse of tomorrow."

But when we look at tomorrow we have lost our vision of Utopia. Consciously people are led to believe the promised future is here. Unconsciously they suspect the vision of new bright lands has vanished forever. Along with our vision of Utopia we are losing our capacity for anger and indignation with what we see going on around us.

In his book *The Dehumanization of Art,* Ortega y Gasset says in a memorable passage: "A fundamental revision of man's attitude towards life is apt to find its first expression in artistic creation and scientific theory. The fine texture of both these matters renders them susceptible to the slightest breeze of the spiritual trade winds."

Architects, designers, composers, scientists and writers are being buffeted by the spiritual hurricane which is shaking our times. Compare the words of Marlowe's sturdy vision which I quoted earlier with E. E. Cummings' poem written with a profound sense of anxiety sometime in the 1940's.

What if a much of a which of a wind
gives the truth to summer's lie;
bloodies with dizzying leaves the sun
and yanks immortal stars awry?
Blow king to beggar and queen to seem
(blow friend to fiend:blow space to time)
—when skies are hanged and oceans drowned,
the single secret will still be man

The belief in the human spirit remains but is surrounded with a deep unease, perhaps inspired by those zephyrs of the first half of the century—relativity and quantum mechanics, psychiatry and sulphonamide, and the new knowledge of the impermanence of the universe. None of this gives a static vision—it speaks of the new relationships and resonances with which the human psyche has to reconcile itself.

And the last verse, in a spasm of buffeted prophecy, foresees our twenty postwar years and the new revolutions that were to come:

what if a dawn of a doom of a dream
bites this universe in two,
peels forever out of his grave
and sprinkles nowhere with me and you?
Blow soon to never and never to twice
(blow life to isn't: blow death to was)
—all nothing's only our hugest home;
the most who die, the more we live

There's the spiritual jet stream for you. There's U.235 and plutonium, A-bombs and H-bombs and amino acids, computers and all the paraphernalia of our moments caught in a poet's glimpse at the start of our epoch.

The poem hints too at the new changes in quality produced by the changes in quantity and the organization of quantity. It hints at mass culture in all its impact, at cinemas, national newspapers, radio and paperbacks and television and tape recordings, at punched cards and computer codes. It hopes against hope that man himself will come through all this and retain his identity.

But it's too late, for surely the point about our present-day condition lies in the Marxist tag, "A change in quantity brings a change in quality." Philosophically debatable perhaps, but tenable when one looks at the changes our new techniques have wrought in modern urban society. The change in the number of man has produced a change in the quality of man. Somehow, compressed and crowded urban man is losing his individuality and becoming a cell in a larger organism.

In fact, for man to survive (and he needs nothing less than a lost Utopia really to achieve survival) he is being forced to accept (albeit and surprisingly rather willingly) a degree of organization that can lead to nothing less than insectivization. The dull routines and social customs of mankind are amenable to statistical measurement and indeed organization is now planned to facilitate this measurement. Within this framework the individual turns in on himself and frenetically tries to assert his individuality and, up to a point,

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the more he tries to do this the more he is a subject for statistical study. From the world of things man is moving to the world of probabilities.

Television is of all this, the twentieth-century born and bred product of our society. By our times, out of our times, for our times. Its electronic principles may be fifty years old but the persuasive networked home entertainment we know today began twenty years ago in 1945. Then there were perhaps a hundred thousand sets in the world. Now there are about one hundred and fifty million. Then it covered a few urban areas in experimental form. Now it is possible to ring the northern hemisphere.

Theoretically a picture could originate in Tokyo, be sent across to Vladivostok, thence to Moscow, through Europe to Britain, across the Atlantic by satellite, across America by landline, across the Pacific by satellite and back to Tokyo. Puck said he'd put a girdle round the earth in forty minutes—that old Shakespearean squarel Television can girdle the earth in about a fifth of a second, and it's no longer a miracle. Along with our contempt for spatial environment has come a loss of wonder. *Sic transit gloria imago mundi*—thus passes the glory of the image of the world, and man looks around and wonders who devalued his psyche.

Those who sense this loss react strongly; for instance, television has become the chopping block for the liberals. While in the 1930's they indulged in political or social activity, now their attentions and frustrations are turned on the mass media, with special emphasis on television. If juvenile delinquency increases—blame television; if there is any decline in moral standards—blame television; if man feels cheated in any way by this society he has created, then the blame is turned on television.

In one aspect, and alas its most common aspect, television as practiced today is just one of the many windows through which we observe, transmit and reflect our valuation of society to each other. If indeed there has been a change in the quality of life, if indeed our times have belittled our stature, the television medium in this aspect only responds to and reflects the social climate. It has little to do with the initial creation of a spiritual trade wind. It is only a sort of air conditioner that processes and gets this wind into homes more quickly.

There is, however, another aspect of television. There are times when television acts in its own right, when it evaluates the new Renaissance in its own terms, when it uses its power of communication not merely to convey other people's images but rather to create out of its potentialities its own genuine statements. This is the television at which we in television have got to aim. When we do we can claim equal responsibility with those who create the values of society. With architects, authors, scientists, designers, film-makers, with all those who create and communicate original work.

If we avoid enlisting in the creative spearhead, then television abandons itself to the role of reflector. If we in television do not have the courage to speak our own mind—utter our own statements—then there are plenty who will buy our time from us, for communication, like nature, abhors a vacuum.

If television chooses to take the side of the creative talent, it joins with those trying to reach a new relationship with the shifting face of society and the fading importance of environment. It will react to the different visions of how this might be achieved. For the poet: "The single secret is still man." For the composer: It can be as escapist as romanticism or as brittle and "switched on" as the new sound. For the artist: Let a Francis Bacon painting speak for itself. For the architect: Let me quote from a recent publication: "We are concerned not with architecture or town planning but with the creation of environment for every scale of human association." (Saadrach Woods, 1963.)

Perhaps the architect speaks his mind most openly. At least he admits he wants to tailor the cosmos. He might be accused of the sin of pride but he latches on to the important truth that man must continually strive to live in a homeostatic relationship

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with society as well as environment. For it is this aspect of feedback, and control by feedback, that has become more important to our creative thinkers than the old indefinable frozen moment when things were still against a sharp background.

This is the new relationship in which television must share, the new relationship of man to his world, of man to art, the newfound relationship of man to mind. Recently in a B.B.C. program we asked a psychiatrist to define mind:

Interviewer: If the mind can influence the body to make a father experience the discomforts of pregnancy, how do you define mind, Professor Trethowan?

Professor Trethowan: Well, that's very difficult. Mind: mind is a function of the brain, it's a function of the sensory organs which feed it, it's a function of the motor organs which give it expressions. Mind, I think, is communication. Communication between man and his environment, communication between man and himself, communication between man and man. Mind is feeling and knowing. Knowing comes from the barrier of consciousness and mingles with the other contents of the deeper parts of the mind, is reflected back again like sound from the ocean floor where it breaks consciousness and modifies knowing once again. What we see here is mind as a continuous oscillating, fluctuating process, it's a cybernetic process, there's a feedback between man and his environment, a feedback between the inner man and the outer man.

These new thoughts, these new relationships and resonances are what concern us today. Perhaps we've not lost our vision of Utopia. Perhaps it's changing. As man changes. Perhaps what we're all a party to is a struggle between man and mankind: the point of evolutionary decision between Homo sapiens and (dare I coin the word) Homo cyberneticus.

If television is to play its part in helping man define his role then on its part society must know what to expect from this electronic window—whether merely to expect a reflection from the glass or whether to expect a good view of the cultural countryside.

What is the role of television? It's difficult to define. At its most ordinary it acts as an extension of vision. It relays routine information, routine entertainment, routine education, into the drawing rooms of the audience. At its best it bestows insight. It heightens perception, reveals new relationships and brings with it a new view of our daily lives.

Television is rapidly becoming one of the main contributors to the stream of information that makes up the feedback from the world to man. In taking over, ruthlessly and with compulsion, television processes other media and tends to drown them out. Before the electronic age there was a time when the channels of information, painting, music, literature, were held in balance and did not draw on each other very much. Mass communications, especially television in its routine moments, now draws relentlessly from all other media, from films, from literature, from graphic design, from theater, from events. In doing so—both because of its limitations and because of the frequency and thoroughness with which it does so—television is tending to act as a great leveler, a sort of tomato ketchup on a feast of culture.

If this is so then all the more do we have to be wary of the ubiquitous images of television. Those images are aggressively sociable and the medium that carries them technically complex; because of their easy acceptability and the facility with which they reach us in our homes these images become more credible, more important, than the reality they represent. Television supersedes reality and this new reality, this electronic picture, is a pale and transient thing compared with some of the images lying around our cultural supermarket. For instance, have you ever seen a TV picture that was really beautiful in the same way that some photographs are outstandingly so? In TV there is little or nothing that is pictorially beautiful. I suppose it has something to do with the size of screen, lack of definition and transient nature of the medium.

No, television is at its best when it's not trying to ape other media and achieve goals outside its limitations. Television is at its

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best in raw direct communication between people with things to say. Television favors the articulate and scorns the dumb. In television, unlike the movies, a word is worth ten thousand pictures. Television's real discovery has been the extrovert personality, the bridging of distance and, above all, the immediacy of the happening.

While there are advantages and disadvantages inherent in television itself, the mere business of operating the medium carries its own share of mixed blessings.

At the moment there are several limitations in the number of frequencies available to television operators. This of course means that under present legislation here and in Britain there is a limit to competition.

Making these channels available to the largest audience entails large financial outlay on capital equipment and high operating costs. Nevertheless it has been discovered on both sides of the Atlantic that television is amenable to the same management principles as any other mass distribution process. These principles require that the largest potential audience for a given type of program be reached at the lowest cost. Television by any present criterion of efficiency is too expensive to exist in a vacuum.

The managers of TV running their enterprises on a basis of profit or cost effectiveness are well aware of these problems. However, as they shuffle their programs on the chessboards of their schedules, they are aware that in the eyes of their critics the competitive search for audience, the rate at which television swallows material, and the sheer amount of air time to be filled tends to make them play down to lesser cultural levels, supporting complacency rather than satisfying aspiration.

Obviously there is a large measure of truth in the criticism. Alas, the more so on your side of the Atlantic than on mine. But these problems are worldwide—television's costly and complex technical facilities tend to lead to a homogeneity of product on the one hand and on the other have far outstripped our knowledge of the audience.

We know some things about our audience. In most cases we consider it to be very large. For instance, in Britain certain of our television shows can command an audience of up to forty percent of the adult population of the United Kingdom, that is, about twenty-two million people. This is the mass audience the advertisers and professional managers of television are interested in.

On the other hand the audience is very intimate and very small—the family circle grouped around the television set. This is the audience that the television producer should be interested in. For television is an intimate dialogue, a two-way interacting variable between producer and receptor: "a continuous, oscillating, fluctuating process, it's a cybernetic process, there's a feedback between man and his environment, a feedback between the inner man and the outer man." Forgive me for again quoting that definition of mind but that's what television should be about, and I suspect that in the case of a successful program "the oscillating processes" at both ends of the system produce an intellectual resonance in audience and also in producer.

To take an analogy from another area, this small intimate audience is the fundamental particle of which the mass audience is composed. Like the fundamental particles of physics it is subject to indeterminancy. That is, if you try to experiment with it the mere act of experimentation alters the nature of the experimental subject and therefore renders the experiment valueless.

The prime arts work at this quantum level. Composers, authors, painters don't try to gratify an audience. They try to communicate. If they communicate to a large number of those quanta of society so be it, but it is not their prime purpose in life. And it is working in this area of uncertainty and unpredictability, of having to rely on intuition rather than knowledge, that distinguishes the artist from the craftsman.

But for the manager with a large competitive stake in television this is a most unsatisfactory state of affairs. He can't afford

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failure and therefore he invokes mathematical statistics, for while the individual is unpredictable, the mass is only too subject to measurement.

Consider a scene that for me is even more important than those old visual clichés, the A-bomb explosion at Alamagordo or the rockets shooting up from Cape Kennedy: the grounds of Naworth Castle in England. It was under a rock overhang on those grounds in the year 1889 that Francis Galton first formulated the idea of mathematical correlation: an idea that made it possible to represent by a system of numbers the degree of relationship or of partial causality between the different variables of our ever-changing universe.

That picture should be the icon hung in the office of every television manager, for by using the techniques based on Galton's flash of intuition he can with some degree of safety ensure a mass audience for his product. And not merely this. The fabricators of his product have made it so bland that it suits all palates, for the ultimate discovery is that the television he has made to please a national mass audience will, with adjustment of language, gratify an international audience and travel with ease from country to country.

In view of the fact, this odd thought occurs to me. C. G. Jung proposed the idea of a collective unconscious. I wonder if the spread of television is not more than playing its share in the formation of a collective conscious. As people for the first time really see each other on the screen, on one hand they might get an idea of each other's humanity, but on the other the process whereby man becomes a cell in an organism inevitably will be speeded up.

Throughout this paper I have stressed that television is something created by our times for our times. We live in an age where the information about our world is increasing exponentially. We live in an age where man is graduating from machines that amplify his energy and assist his muscles, to machines that amplify his mental capacity and assist his intellect in the control of his surroundings.

Television is something new and persuasive, one of the two media that can keep pace with the times. Perhaps the formation of this collective conscious is just the first step in the new directions that man is taking.

Recently in one of our programs we did a story on trends in science fiction, interviewing many authors. Since this genre had already predicted flights to the moon and telecommunication satellites as far back as 1910, we asked these writers what areas concerned them at this moment. Their answer was robots! And they saw man building parts of his robots into himself.

Clearly they see the emergence of "Homo cyberneticus." The new trend, this spiritual trade wind, is already discernible. Western man is desperately trying to come to grips with the machine. He sees his individuality being submerged in a tabulated mass, his ideas being catalogued in a memory store, his actions being predicted in the banks of calculating transistors. This trend explains the popularity of television shows that depict man in a dominant friendly or understandable relationship with a machine: "The Man From U.N.C.L.E.," "Dr. Who" (the Daleks), the James Bond stories. It also explains pop art, op art, recent sculpture and science fiction.

Unlike other intellectual revolutions, in which the thinking only slowly percolated through the strata of society, this revolution is likely to go quickly. Television has already started the work of feedback and information with unrivaled rapidity. But in operating at the predictable mass level, in so consciously attempting to please, the medium is throwing away opportunities, all too often wasting its potential in internal rivalry, failing to attract the best talent and thus not providing the motivations expected of any leader.

This situation grew out of the beginnings of radio, for this first precursor of television started in an atmosphere of hotly debated political compromise. In the United States it was decided that it should remain in the hands of private enterprise, in Britain it was thought too big to be dominated by advertisers, and so we started the B.B.C.,

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whose independence was assured by the unwritten checks and balances in our own constitutional process. Since that time under your antitrust laws you've had to break up one network. We in Britain decided that monopoly was stifling and brought in a second television system, this one based on advertising.

Systems that have grown out of compromise are not necessarily the answer. They are too big, too heavily involved in getting audiences in order to prove their efficiency and justify their capitalization. Yet can any other system provide the amount of high standard continuous entertainment, information and education in such a widespread manner?

Why has nobody attempted to undertake a design study of a television system in present-day terms? I don't know what such a study would produce but the specification outlining the parameters of the design might be as follows:

"Mankind needs a system of television communication so designed and controlled that communication can occur between all levels of our audience and all levels of the culture represented by that audience. The audience should be able to select from any of these levels when and as it wishes. In order to achieve this, ways should be explored to ensure that the costs of television apparatus and production come down, thus reducing the operator's need for large audiences and enabling him to design programs for the unit rather than the mass."

The rub of the design problem would be to prevent such a system from becoming an Orwellian nightmare, for such a window on culture would be a two-way affair in which the image might well increase its transcendence over reality. Television receivers would become communicators; not only would they receive local network and international programs, but by means of wave guides (to provide the channels) and small cameras and cheap video recorders they would become a link between the viewer and his personal world, between the home, the library, the bank, the office, the shops and, of course, the Government.

To design such a machine is problem enough, but to design a system (no! let's call it a medium) not merely for social communication but also capable of responding to the whole range of values and spiritual needs is problem indeed. It is the very heart of the design challenge and of our present dilemma. For the paradox is surely this:

On the one hand mankind needs a large "machine" element in order to integrate with the new cybernetic culture so eagerly awaited. These machines, mechanical, mathematical and social, are utterly essential if mankind is to come to grips with and accept his new environmental surrogates, the equivalence of space, time, energy and mass.

On the other hand, man—the individual man—recognizes that in using these machines and adapting himself to their techniques, he must assume their attributes. This is the moment of terrible truth, for in gaining "the sweet fruition of an earthly crown," the individual risks submerging his humanity and becoming a digit in a socio-cybernetic system.

As a television man I know where I stand. I believe that it is not the job of mass communication to pander to mankind. Rather we should use our ubiquity to seek out and service the individual.

I believe that television, given the opportunities, can be more than of our times, out of our times and for our times. I believe it can be ahead of our times, providing crucial leadership, fostering man's awareness of his position, providing the feedback that enables us to utilize the full spectrum of our total vision. It will be and should be an open window on our culture, helping to ensure that "the single secret will still be man."

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Tawn Before Green

MELVILLE CANE

Far earlier than green,
It is the tawn
Steals in
To color April's dawn.

Tawn before green.

Delicately the willows
Array, with wealth of yellows,
The heartening scene,—
Tans, russets,
Saffrons, mustards,
And rare gold within,—

Tawn before green.

✪ MELVILLE CANE will publish in the spring of 1966 his eighth volume of poems, a collected edition entitled *So That It Flower.*

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Responsibility in Design and Information

MAX BILL

Vision 65 is a congress about communication and information methods. But when Will Burtin asked me last year in Zurich to come I said "yes," because I had in mind that the subject would be in the field of the shaped environment, that is to say, something close to my own practice and not something so far away as communication and information. But then I thought that visual design—from the spoon to the city—has to do with information and communication, and is also visual communication. And so I came.

It is very hard for me to speak here following the brilliant expositions of the speakers who preceded me. The address given by His Excellency, Ambassador Diop, pointed out so many problems in the right and useful way that it is difficult to add anything. On the other hand the ideas that Mr. Buckminster Fuller developed were so much a projection in the future that it is not even possible to discuss them.

In Ambassador Diop's speech, I appreciated most his approach to the idea of conserving original cultures and to understanding the value these original and authentic cultures have for the whole world. This will become even more important in the future we face, because standardization on an international level will affect higher developed civilizations (as in the U.S.A.) as well as the countries in development (as in the African states).

We all know that we live (the United States is an outstanding example) in a world of accelerating development. Information and communication are at its basis and are open to great misuse. For what does happen? Instead of real information and the proper use of the means of communication, we sell gadgets, sell every kind of nonsense, sell even things nobody needs. This may be one of the reasons why I agreed to come here and to make this point clear, because it is not often enough told.

We live in a world where the smallest problems are not yet very well solved according to human needs; not even the small problems of our environment are solved (which one finds out when one tries to find a good door handle, not to speak of a well-designed city or even part of a city). Although we have an enormous technical and scientific progress, our mental and moral progress lags behind, is even in regression. That is to say, the accelerating development of our society is one-sided. Properly used means of information and communication are one of the basic conditions to reestablishing balance.

This is the struggle in which we are now. With all the scientific methods at our disposal, we have the possibility of proving many things by feeding the problem into a computer. In fact, the computer can be a help for many things. What does this mean?

There is an input and there is an output. We have such a system in our brain and a similar system in our society. When we consider the whole administrative system of a state or of a city, we have a kind of computer with detached programs. However different the input in these administrative systems may be, the output remains more or less the same. The computer is a machine and does what it is told to do. What counts is the responsibility, in the beginning and in the end, of computerizing the data we need to make our society work. In other words, the computer needs a leadership. The input needs a leadership, and the output needs a leadership.

We have, for example, well-working in-

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stallations for military use. Military forces all over the world have very large and interesting machines to figure out possible military events and the actions to take. Many of the problems we are confronted with today derive from decisions made by machines, and in the end by the military people who operate them.

Obviously we need another point of view than the military one. But the only thinking machines working on world-size programs today are for military and commercial use. This is the reality we are confronted with. Truth has a very weak background. Moral and ethical measurements are no longer stable, or are no longer used as they were in older societies. Societies must change, of course; all things change. We have the means and methods at hand to get clear information on these problems of change of values. This is the least we can do, and maybe doing so would reestablish a balance of interests.

The future is an open field of possibilities, but we must think over this future, must establish something like "futurology," something like a new science of the future. We also can state our problems to the computer and can propose a kind of "cyberculture." The question remains: Who is leading this? The consumers certainly are not the leaders. The leaders have to be creative people, people with a certain imagination, people with a certain outlook on the future and able to take their share of responsibility.

But there is another handicap: computers used in the humanities often are not exact. They are lost if the problem needs interpretation. An interesting example is the story of the computing machine used in a test case for translating a text from English to Russian and back to English. When the text came back to English, it was a completely different version of the original which had read: "The spirit is willing but the flesh is weak." The final translation read: "The ghost is ready but the meat is raw."

What is apparent in this kind of a joke is that somebody must take the responsibility for interpretation, for the choice of medium and for the choice of the final result. Who are the people willing and able to do so? I think that these "leading" people are in the design field. They must be the designers, not the producers. In the planning field, they must be the planners; in the information field, they must be the informers; in the political field, they must be the politicians. They must be conscious of the need for a very clear response to human needs, both for the individual and to society as a whole. As a matter of consequence, I think that we do not so much need new methods of communications; I sometimes think that even the existing ones are too much, or are misused in such a way that they seem to be too much.

Until we learn to use our present resources reasonably and with full responsibility, there is no use for any change. Every change brings only more struggle instead of welfare, if the actual problems are not solved. Therefore we should find out which mediums are the best ones to give satisfaction to society. And then we must accept responsibility. Then we, as architects, publicists, politicians, designers, will be the makers of a world adapted to man in the age of technology.

Let me close with a citation about the equality of man from George Orwell's *Animal Farm* and give it a positive instead of a satirical interpretation: "All animals are equal but some animals are more equal than others." For us this will mean that the more equal ones—those who know more and have creative minds—have to take on more responsibility. This is a program in ethics, not one of technical change or so-called progress.

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The Creative Human Factor in Design

MICHAEL FARR

The human factor referred to is the user of products. I am going to explore some of the implications of his new role in the designing process.

We have in the users of designed products and services a vital source of information that can help the designer to be more precise in his work.

No longer should we wholly imagine what people are likely to want—or be content with what conventional market research tells us they can be expected to need.

We must find ways of knowing the user, so that when he has our product he can still find scope to "fix it" precisely into his personal living scheme.

We have a shrinking world with expanding problems

Now we can communicate with all people in all countries. Mostly we communicate by broadcasting or by sending products to them. Do we stop to listen for their answers? And do we understand their responses when we do receive them?

Most forms of design are aspects of trade. We export our designed products wholesale. From whence and from whom do we import our ideas?

Do we detect an echo beyond the point-of-purchase barrier?

What *are* we doing?
How are we doing it?
Who are we doing it to?
Why?

We are considering the directions or redirections of design energy, so each of us must look, listen and feel for answers to these fundamental questions.

Einstein said: "Perfection of means but confusion of goals characterize our age."

Many designers are more than competent at conveying new desires to vast audiences for commercial purposes. They have, in a sense, perfected the means that Einstein spoke about. Are they to go on unchecked?

The world grows smaller as our techniques of communication improve. But even with the aid of these techniques, we are not

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designing for a world society, and we should stop pretending that that is even possible or desirable.

Instead we should be designing for a cohabiting system of different regions, each with its indigenous culture. When we design for regions other than the one we personally belong to, there is, currently, a danger of deadening the user's response. I say "currently" because a better *rapport* between designer and user would allow the user to develop with us his valuable, local, traditional experiences. And we could establish that *rapport* through more sophisticated methods of communication and trade.

In our systems of designing there is a place for the feedback of information from the user that could profitably modify our designing.

Adam Smith said: "Consumption is the sole end and purpose of production, and the interest of the producer ought to be attended to only so far as it may be necessary for promoting that of the consumer."

We know—or think we know—what human values are. We must put a price on them.

People in a crowded street with traffic and proliferation of signs

This could be anywhere. Anywhere in England at least. And that is sad because once it was somewhere.

Characterless office blocks

Row of semidetached houses

We are obliterating human contrasts

We have had fifty years of planning and it has produced an opportunist and essentially planless society.

Underdeveloped people in overdeveloped societies: that is us, *and* them. We are hampered by social systems and legal frameworks; by power blocs and cosy cliques. But these are part of the evolving pattern of every life and in designing we must take account of them and, more particularly, of the people they represent.

How do we communicate with people through the blocs and systems, the frameworks and the cliques?

How can we establish contact with the human values that regenerate our designs?

Nobody should have to put up with what he believes to be ugly or knows to be useless.

So we ask:

Is mass production inherently unsuited to the satisfaction of single needs?

Are methods of distribution alien to the satisfaction of an individual user's requirements?

Is mass advertising fundamentally unrelated to the satisfaction of the different needs of different people?

My answer is No—but we shall have to teach

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the manufacturers, the
distributors and the agents
new tricks.

Recognizing local
requirements the single factory
of a company in the farm-tool business
can cater for the individual needs
of counties and regions and still
make a good profit. Here, feedback
from the different users is alive and
real. They know what they want, the
company knows it, and they get it.

The living tradition of design was
strongest in the countryside.
Speaking of England,
indeed of a particular part
of England in 1923, George
Sturt wrote in his book
The Wheelwright's Shop:

"I only know that in these and
a hundred details every well-
built farm-wagon (of whatever
variety) was like an organism,
reflecting in every curve and
dimension some special need of
its own countryside. . . . They
were so exact. Just as a
biologist may see, in any
limpet, signs of the rocky shore,
the smashing breakers, so the
provincial wheelwright could
hardly help reading, *from* the
wagon-lines, tales of
haymaking and upland fields, of
hilly roads and lonely woods . . ."

But then it was one product
by one designer for one user.
The billhooks survive, but
whence came the refrigerator and
carpet sweeper? They are oriented
more to the mind of the ad-man
than to anything connected with a
real human environment. Which is
odd, because people *are* different,
and their differences are more
pronounced when they are concerned
with functional objects in direct
contact with personal, preferential
methods of work by hand.

When functional objects are
not operated in contact
with the human body the design
motivations can be most varied.
Hence a well-known bell and chime system
design derives from broadly agreed
architectural concepts and the products are
sold in unvarying forms in
forty-six different countries.

Considering these, and remembering
the billhooks, we can now suggest
that local, regional design
differences may be more welcome when
the product comes into contact with
the body. And for most of us that
is most products.

When being fitted
by a tailor
for a new suit
the user participates
in the designing process.
He keeps his demands—as
we all do with clothes—
within the reasonable
tolerances of the manu-
facturing plant that takes
its instructions from the
tailor.

This represents a stringently
priced, twentieth-century
industry; how many other
consumer-product design
systems display a similar
receptiveness to individual
needs or, like this multiple
tailoring business, build in
a feedback facility at the
fitting stage?

Designers are not responsible to
communities; can they
modify their responsibility
to manufacturers in order to
cater for the needs of
individuals?

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What *do* individual
human beings need?

They need to be themselves

—only more so.

Now that they have the leisure
to develop themselves,
will human skills reemerge?

Can designers
nurture these skills?

I look forward to seeing
the dark Satanic Mills
produce the "tools" of
leisure.

Is it possible to
conceive partial
designs that can be
fitted together to make
different wholes? Can
units that are anonymous
link together to
become individual entities
for particular people?

Begin in the kitchen. At
present, in most countries,
kitchens, whether built-in
or not, consist of separate
appliances that are owned,
not rented. These appliances
are possessions and the user
is expected to be most satisfied
when they are technically and
stylistically up-to-date.
Stoves, rotisseries, freezers
and washers are separate,
partly because they are more
easily sold as single units and
partly because technologically
each tends to develop at a
different pace from the others.

So that we may see a way of
linking the user's particular
needs and desires to the
design function, I am going to
ask you to contemplate an
alternative system of trading:
a system of renting, and never
buying, each powered kitchen
appliance. This is not hire-purchase,
but renting. The basis of the system
would be a patented and a subtly
adjustable series of wall-hung
and floor-mounted racks.

The appliances—which should at
this stage of the idea
be all electric-powered—
would be fixed to the racks
in positions exactly suited to
the individual user's requirements.
If the user should change her mind
after experiment, then the
appliances could be re-fixed in
new positions.

To make the system work it is
suggested that the electric
supply company should own
the racks and be responsible
for installing them in each
kitchen area. The racks
themselves could be produced
in different finishes and
colors so that they would not
be dominant elements in the
kitchen scene. They would also
be designed according to a
prearranged system of dimensional
coordination that would allow
wide tolerances.

Such an open system would immediately
allow the many and varied
appliance manufacturers to
supply their products without
drastic modifications to existing
designs. Initially the chief
problem would be in changing the
methods of suspension—chiefly
from floor mounting to wall mounting—
by means of the racks. While the
electric company would own the
appliances, the manufacturers would
be responsible for maintenance and
service.

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Why indeed should we bother about such a seemingly cumbersome method of equipping the kitchen? It is in the long term that its advantages become striking and significant.

From the user's point of view a relatively inexpensive and flexible working arrangement becomes available. Each item of equipment is placed precisely in the right position at the right working height, so that she achieves her own personal, integrated kitchen.

The user can also exchange, at will, an existing appliance for a new one. After installing the improved version the renting company refurbishes the retrieved product and rents it to another user at a reduced cost. Such a process would continue throughout the social scale, so enabling all users to be equipped with the most appropriate series of products they can afford.

The suggestion that each appliance should be maintained by its manufacturer is significant. I am stressing this because a properly briefed service engineer can observe product performance in its actual working context and report back to the designer. The designer cannot hope to know the personal needs of the vast numbers of people who use his products. But through his company's service and maintenance staff he can develop sensing antennae that bring him into closer touch with his public.

The information that is fed back to him in this way would not only tell him how his product measures up to competition, it would, when skillfully analyzed, indicate significant trends in user behavior.

The designer cannot obtain such information under current trading systems, because with them there is relatively little scope for the individualities of users to show themselves. Within the rented racking system the user plays a dynamic role in the design process.

I said that advantages would begin to show in the long term. They are advantages that would appeal to all parties.

The user can always have an up-to-date "tailor-made" kitchen.

The designer gets feedback from a relatively untapped source and can thus begin to design new appliances (as whole products or as interrelated parts) that are more subtly suited to known user requirements. And as he works he has in mind a valuable constant factor—the rack system—upon which his ability to "out-design" his competitors will be stretched.

The manufacturer gains because there will be greater receptivity for technical improvements, which would lead him to introduce new products for more valid, promotable reasons and hence reduce his dependence on policies of styling for artificial obsolescence.

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Finally the renting company would not only be able to develop a profitable business, it would establish a stronger hold over the users of its basic product—electricity.

I have deliberately couched this argument in commercial terms because, to have any sense of reality, the concept of the creative human factor must be integrated with the world of business. If the traders can see that there is stability in such a system—long production runs of parts, units and whole products to meet predictable requirements—then they will support methods by which the user can play an active part in designing.

Underlying these proposals is my conviction that neither the home nor the plant in which domestic products are made need be as static as it is. We should see a developing trend to break down whole products into units—into compatible parts that can be grouped together to make new wholes.

The parts can be mass-produced economically with all the mounting sophistication of automatic transfer machines now at industry's command, but the wholes, the product entities themselves, could be varied to suit their precise purpose for a particular person.

Can we, in the face of such possibilities, expect to witness a regeneration of user skills? Such product flexibilities deserve an answering intelligence, or their capacities to serve will remain unexploited.

Would we not agree that the greatest source of personal satisfaction is in being creative? The do-it-yourself practices in countless homes are one expression of this desire. Now that more and more leisure time is becoming available, the means of self-determination denied in many "work" situations must be provided.

What are the new tools of leisure? Beyond the power boats and water skis there is a recurring physical and psychological incompleteness. Can we supplement the common props of leisure—sport, radio, books, TV—with the designed equipment in the home?

People's homes could be three-dimensional chessboards. Each piece in them could be rented and each one designed right for *its* job. Each piece would be exchanged or discarded when a technically better version appeared.

The user makes the moves, beginning with the pawns (curtains, wall-paper, china), and moving on with increased skill to bishops (beds and lighting) and to kings and queens (cooker and freezer).

By breaking down our design concepts to think more of units than of wholes, we

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could provide people with self-organizing systems. We could give people the components to be self-repairing—in the psychological sense—and, by not usurping their function, we could give them the desire to be self-regenerating.

Certainly the designer makes the first move. But he should not attempt to master everybody's game. The German architect, Adolf Loos had built and completely furnished a house for a poor rich man, and he objected to any alterations. The man's granddaughter gave him a pair of embroidered slippers. "But," said the architect, "don't you see, you are complete."

New conceptions of the designing function are needed. We have the means—computer-assisted communications techniques and computer-controlled production processes. Our job is to write good programs.

Put simply, by planning with man in mind, we could find means of enabling *living* environments to be reconstructed in ways hitherto inconceivable.

This is indeed a challenge for the designer. He has to see beyond the obvious demands of the present, so that the user can revise his position in terms of new designing. Always it must be for the designer to provide the needed series of first opportunitites to sample new experiences.

His prescience is the vital factor before we can begin to feel an influence from the creative human factor. Human enrichment stems from random creativity, designers *grow* as creatures of contrast—the users of their products can be expected to do the same.

The home is not the whole of life. Internationally, nationally and regionally, we should be able to postulate plans, but we should present them in broad concept only. Just as in designing for the home we can foresee ways of acquiring new knowledge, so in the wider context it would be wise to develop and check our ideas pragmatically.

Again, conventional market research is no tool for this task. We need to develop systems of unfettered feedback from affected human standpoints. We need to acquire information, not by Gallup, but by social observations.

We need a design outlook that embraces forethought but leaves sympathetic gaps.

Designing down to the last detail can often inhibit much valuable individuality that is randomly generated. People will respond to new ideas and new product possibilities in different ways. Comprehension is achieved at different levels. We would be designing for human satisfaction if we were to make it possible for

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people to select and separately enjoy *exactly* what they need to know and desire to experience.

These ideas are not as cold, clinical and calculated as they may seem; rather this attitude toward designing is more romantic than classical. Romanticism is defined as subordinating form to theme, subordinating the whole to the parts.

I have spoken of designers as single creators; rarely, if ever, is designing today carried out in isolation. We all work in teams, however tightly or loosely we define them or use them. I have spoken about competitiveness, for that is an inescapable fact of commercial life. But our collective job is to develop our skills for a common purpose. If we can link our experience with the new sources embodied in the creative human factor, new and more rewarding purposes would open up before us.

Whenever possible, the designer should enable people to enhance their individualities rather than suppress them.

✪ MICHAEL FARR, Chairman of Michael Farr (Design Integration) Ltd. and general secretary of the British Design and Industries Association, spoke at the Vision 65 Conference. He is the author of *Design in British Industry—a Mid-Century Survey*.

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A Castle on the Danube

MARY OLIVER

Surely truth is the universe of the very young;
Surely it belonged to us, a household of children
With so much time.
Or if I am wrong, consider those who sit
On lawns or in bedrooms assembling
The blue myth of childhood, the splendid
Passage of years combining to such leisure.
For three years before my grandmother died she sat
Imperial on the dark porch of summer
Recalling her life in a castle that bordered the Danube,—
Who was two years old when she rode in her father's arms
To the edge of Ohio.

Say the old,
"I remember, I remember," but surely it is not anymore
The truth they offer. For what, from those narrow files,
Would draw small listeners from the sun? Grandmother,
It was no harm, I think,
The way you called to us and when we were gathered
Like a last fragile blessing,
Rowed us to that blue river,
Borrowed in your need another kingdom, and drew us
One by one through the mad castle door.

✪ MARY OLIVER was born in Ohio and now lives in Massachusetts. Her first volume of poems, *No Voyage and Other Poems,* was published last year.

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Film as a Non-Art

An Approach to the Study of Film

SOL WORTH

My title is not meant to be a statement of belief, a challenge to the artist, or a manifesto calling for a new "new wave" of non-art or anti-art films. It *is* intended to imply a particular direction of inquiry into the nature of film and the film process—to explore a group of questions that emerge from that inquiry.

This implied direction will lead us to look at film as a process and as a medium of communication, rather than as an art or an art form—and will, therefore, depart from standard aesthetic theory and attempt instead to apply some of the current concepts in communication theory and psychology to the study of this specific form of visual communication.

I would like first to examine briefly the concept of communication and visual communication as it relates to film; then, to outline some previous attempts by philosophers, aestheticians and psychologists to deal with pictures, images and films; and finally, to suggest that film may be examined as if it were a "language," and to explore some of the problems in communication and linguistics that develop from this attempt.

My purpose in examining film and the film process in this way rests on the assumption that the frameworks of communication and linguistic theory may throw new and exciting light on the question, "What does a film communicate, and how does this process work?" The very form of the question—the use of the word "communicate"—helps to clarify the specific nature of the inquiry: to examine film as communication—as a mediating object, and process, through which humans interact in certain ways.

Communication is one of those words that seem to be cropping up everywhere, referring to an ever increasing list of phenomena and behavior; yet it is a word that has only recently come into scholarly and popular use. The 1895 Encyclopedia Britannica, for example, does not even include the word in its index. By now, of course, so much has been written about communication—its processes and problems—that we may rightfully ask whether studying film as communication will help us to understand what happens when we see a film. Although many formulations and definitions of communication have been developed, and many of the current theoretical discussions, definitions and theories of communication would be relevant to this inquiry, so comprehensive a task is beyond the scope and the needs of this discussion.

As I will use the term here, communication can be broadly thought of as *human interaction through messages.*

Just as I have, for the purposes of this inquiry, limited the concept of communication to exclude animal and machine communication, so would I like to limit the concept of visual communication before I define it. A further distinction that must be made is one between the so-called mental or internal image, introduced by Edward Titchener and the introspectionist psychologists, and the commonly observable external image or picture. These psychologists used the word "image" to refer both to what one saw with the eyes, and to what one

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saw in the "mind's eye." In writing about verbal communication Lev Vygotsky and others have suggested that we distinguish between these two by calling the internal image thought, and its external expression language. Margaret Mead has also suggested the term "pictograph" to distinguish this commonly observable external image from its internal or mental counterpart. I shall use the word image throughout as consistent with Mead's "commonly observable *external* image," and with Vygotsky's concept of *external* expression.

Such diverse activities as reading, watching facial expressions of people as they talk or respond to talk, the "kinesics" of Birdwhistell, which he calls the language of gesture, the nonverbal communication studied by Reusch and Bateson, painting, architecture, graphic design, the look of a newsstand, television and movies have all at one time or another been treated as visual communications. Obviously they belong together by virtue of being related to seeing, even though we do not yet know enough about the processes of visual communication to describe them all adequately as similar phenomena.

I shall define visual communication as: the *transmission of a signal* received primarily through visual receptors, which *we treat as a message by inferring meaning from it.* (For the purposes of this paper, the range of signals under discussion will be limited to those commonly called film or motion pictures.) This definition offers us several clues that help us to clarify our original question: What and how does a film communicate?

If film is a specific set of signals, that we decide in some as yet unexplained way to treat as a message, we can ask, what is there in any signal, or in us, that tells us to treat it as a message; and, what is it in us or in a film signal that tells us which part is message and which isn't—or even further, which part is more message—has more information—than other parts. We can also ask, what in the signal that we have decided to treat as a message allows us to infer meaning from it? The definition I have just given implies that there is *no* meaning in the film itself, and from this we can infer a definition of the word "meaning" that we might apply to the study of film. We can say that the meaning of a film is a relationship between the implication of the maker and the inference of the audience. Although the meaning of a film is inferred in large part from the images and sounds in sequence in the film, meaning is clearly that which *we infer* from the film—from its elements, units and parts.

It may be postulated, therefore, that film communication is the transfer of an inferable meaning through the range of materials that a film offers or does not offer as signals, and through the elements and combinations of elements it allows or does not allow. These materials and elements impose their own constraints upon the signals we receive and choose to treat as messages. It is these filmic materials, elements and constraints, and their relation to the meaning we infer from them that we must study in order to know what happens when a film is seen, and when we say it has meaning.

Our question can be reformulated in this light to read, "What does a film mean, and how is someone able to infer this meaning?"

The question of meaning in pictures is hardly a new one. While film communication is a recent development, communication through pictures goes back almost as far as man himself, and questions concerning the meaning of his pictures have been discussed in a great variety of ways. It might be helpful for us to look for a moment at some of the past attempts to analyze pictures, and specifically, at those attempts that have dealt with the question, "What do pictures mean?"

Many of the attempts to analyze pictures, dating back some twenty-three hundred years, were undertaken by philosophers and pursued the normative question of evaluation—is the picture good or bad, beautiful or ugly—rather than the substantive question of meaning. Although the past hundred years have seen the beginnings of a systematic interest by aestheticians and philosophers in the substantive questions related to pictures, and although this interest has wandered freely over the map of

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human interests and understandings, emphasizing at various times the religious, expressive, sensualistic, perceptive, cognitive, illusionistic, symbolic, nonverbal, semiotic and psychological approaches toward the understanding and analysis of pictures, it has for the most part maintained one basic implicit assumption: All events that undergo aesthetic scrutiny can and should be judged either as good or bad, beautiful or ugly, or as art or not art. The arguments of the various dissenting schools of aesthetics revolved not around the assumption that the normative question of good or bad was at issue but rather on the specific methods and theories of normative determination.

Some workers in aesthetics, communication theory and psychology have in the past fifty to seventy-five years begun to question this value system which forces theorists to make choices between good-bad and art-non-art, or forces analysis of both extremes of some scale but excludes the middle. This does not mean that the concepts, "art" or "beauty," which have in large part governed the analysis of pictures for so long, are no longer applicable to the study of visual communication. What I am suggesting is that current thought, by conceiving of pictures as part of a communication process, leads one to see the difference between evaluation and meaning. My concern is not whether film is art or not, but whether the process by which we get meaning from film can be understood and clarified. My objections to the older assumptions of art-non-art are based mainly on their exclusiveness and noncontinuity. While all art might be said to be communicative, all communication is most certainly not art. Assumptions that fail to provide criteria for the analysis of messages falling between the extremes of good and bad, beautiful and ugly and art and not-art must prove singularly unfit as basic assumptions for the analysis of films that so clearly fall between these extremes.

I would like to suggest that we consider the realm of communication as a continuum. All human interaction through messages falls somewhere on that continuum. The determination of the meaning of a message is a necessary if not always sufficient condition for its subsequent judgment. The labeling of poles of judgment values on a continuum—whether good or bad, moral or immoral, beautiful or ugly—depends upon many factors extrinsic to the meaning of the message. Let us leave the questions of evaluation, fascinating though they are, to the value analysts, aestheticians and philosophers. I do not mean that when we look at a film we should ignore judgment, but rather that we should distinguish conceptually between the process of inferring meaning from messages and the process of evaluating those messages.

It would be useful then to digress for a moment and try to trace some of the major concepts and approaches to the study of meaning in visual phenomena. Let us examine some of the more recent arguments about meaning in art, and some of the approaches to the understanding of visual phenomena that psychologists and psychiatrists have taken in the past seventy-five years.

The basic argument in modern times over the place of meaning in art might be said to start with Kant, who defined aesthetics in his third Critique as a "judgment of the beautiful in art and nature." Hegel continued this argument some years later and urged that we drop the concern with nature and that aestheticians concern themselves only with art as the aesthetic stimulus.

Although these early nineteenth-century philosophers wrote about the judgment of beauty in art, they did not specifically exclude meaning from art. The attribution of meaninglessness to art comes as a more recent phenomenon, represented by such critics as Sir Herbert Read, who says that "a work of art exists not by virtue of any meaning, but by virtue of aspects of art that have no meaning." Such statements seem to be a result of the dogmas laid down by the logical positivists in the early part of this century.

The logical positivist position on art can be understood through the works of the logician, Rudolf Carnap, who writes about art that "only verifiable statements of specific empirical sciences can be legitimately conceived as knowledge of the states of nature or of matters of fact . . . no object in any mode of art can be of any value in

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acquiring new knowledge. Whatever therefore we take from a work of art may offer emotional or formal pleasure but cannot offer intellectual meaning."

The force of this positivist theory and its wide influence on Western thought in the first half of this century have prompted many aestheticians to try their hands at countering it.

Clearly opposed to both the positivists and the Readian no-meaning group is the aesthetician Henry David Aiken, who sums up the opposing view by saying that "the predominant power of pictures to arouse, sustain, and project emotion is a function not of their quality as shapes, but of their meaning and, in the case of art, of their cognitive meaning."

Lionel Trilling and Jacques Maritain take positions somewhere in between. Trilling, while denying the validity of the positivist position, seems to feel the power of their argument so strongly that he is forced to theorize that the meaning of a work of art is not rational at all. Trilling's resolution is that works of art offer the appearance of thought, allowing one the pleasure of feeling that he understands. He refers to this as cogency, seemingly to differentiate it from the more scientific concept of "cognition." He adds, "it [the aesthetic response] is the appearance of thought."

For Maritain, on the other hand, meaning is neither the appearance of thought, nor a verifiable statement of knowledge. He answers the positivists from the tradition of Thomistic Catholicism. A work of art is "an object of experience." Maritain, like Trilling, does not argue for meaning derived in terms of rational cognition but rather that, "Here is meaning that is different enough from what we commonly call knowledge, meaning which is not expressible in ideas and judgments, but which is rather experience . . . for it wants to be expressed, and is expressible only in a work of art." He equates knowledge and meaning in art as an experience through which we can know God and concludes that "it is a sin for the poet to eat at the tree of knowledge."

Jacques Barzun goes even further and expresses what many of us must sometimes feel when we read the convolutions of thought about what seem to us to be meaningful acts of communication. He throws out entirely the question of what a work of are *is* and how one knows its meaning, and concentrates on an examination of what it *does* for the beholder who enjoys it. "The appreciation of art does not coincide with intelligence," he writes, "what it correlates with no one knows." Not only is there no determinable meaning, but for Barzun it is an antiegalitarian concept for anyone to think that he knows what "The Meaning" or "The Good" in a work of art is. Criticism, he concludes, "is not the field of Armageddon, where one battles for the Lord, but Dover Beach where ignorant armies clash by night."

Not all people who are concerned with "art," however, feel themselves to be members of ignorant armies clashing by night, nor members of a group thinking about the unthinkable and the unknowable. Some, such as the art historian Meyer Shapiro, or the anthropologist Franz Boas, supported by behavioral scientists in many fields, have been concerned with the meaning of works of art as discoverable in the various styles of art. These theorists feel that the meaning of a work of art can best be determined by "searching in a style for the qualities and structures that can be matched with some aspect of thinking or a world view [of a particular culture]."

The meaning of art and of communication for this group lies not so much in individual works but in the broad sweeps and aggregate changes of style across cultures that are explained by varying forms of social life within the context of cultures, empires, dynasties, cities, classes and institutions.

Henry David Aiken's work can serve as a bridge between the formal aesthetician and the behavioral scientist. He takes the position that "the best model for conceiving the aesthetic response is . . . that of the psychological concept of the consummatory response pattern. So conceived, the whole series of contrasts between the aesthetic and the cognitive . . . become gratuitous. They stand in the way of our theoretical grasp of the variability and complexity of which the

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aesthetic experience is capable. It is now possible to consider the alleged incompatibility between so-called cognitive meaning, and aesthetic meaning." The impetus for Aiken's argument is empirical—he is acquainted with much of the thinking that has been done by behaviorial scientists—but his proof avoids (perhaps out of consideration for the sensitivities of his audience) the examination of the empirical evidence and the theories based on research in perception, cognition and the psychology of art and communication.

What we might call experimental or psychological aesthetics seemed to go through two stages. In the latter part of the nineteenth century, following the work of the psychologist Gustave Fechner, three ideas emerged. First the concept of aesthetic empathy, then the concept of aesthetic "play" and finally the idea of aesthetic, or psychic, distance. These ideas served their purpose; they started a train of thought about aesthetics based on experiments in psychology but the ideas themselves seemed to have been laid aside by the later twentieth-century aestheticians.

Three other approaches that might be called the psychoanalytic, the gestalt, and the early behaviorist seem best to characterize the work done in what may be termed behavioral aesthetics, from the early 1900's to just after World War I. These approaches are more strictly psychological than aesthetic, and were motivated more by a desire to explain human behavior in general than by a desire to explain paintings or art.

Stemming from the work of Freud, the psychoanalytic approach to pictures and films germinates from the fundamental notion that the aesthetic effect, and most of man's behavior, can be explained in terms of the working out of a complex of conscious and unconscious personality needs and drives, at least some of which are erotic, and all of which strive toward and often find symbolic expression in behavior or in dreams and in the arts.

The attempt of the psychoanalytic critics and theorists has been to correlate the inferred meaning of the work with whatever biographical data were available about the maker. Whatever formal elements were found in the work were considered as choices of communication alternatives dictated by the personality needs of the maker, and whatever elements were found to be important in the response of the viewer were considered as inferences dictated by the unconscious needs of the viewer, or as conscious recognition and response by the viewer to the personality of the maker.

The second of these twentieth-century approaches—the concept of the gestalt—is concerned not with the personality of the sender or of the receiver, but rather with the perceptual organizing factors of the "units" or "wholes" that are involved in conditioning the meaning we infer from a communication.

The third approach, the early behaviorist, covers a wide range of conceptions and methods which I would like to distinguish from the other approaches. The experimentalists are those who distrust as unscientific any investigations that make meaning inferences on any basis other than precise measurement of observable behavior, and that make predictions from conclusions not drawn from objective measurement. The early art and music appreciation tests by Meier and Seashore exemplify such attempts to quantify and predict reactions to nonverbal stimuli. If aesthetic stimuli have meaning for the viewer or the listener, they reasoned, we ought to find out what that meaning is, or at the very least we ought to be able to measure and compare one person's reaction to that of a group or to that of another person. Dreher, for example, observed in 1948 that college students trained in music sweat more when they listen to certain pieces than college students untrained in music.

Many of these early workers devoted themselves to measuring preferences as a way of arriving at different reactions. Olsen concluded that people prefer full frequency sounds to limited frequency sounds, that ranges of full frequency sounds were found to be more "good" than those of low frequency. In relation specifically to images it was found, for example, that little boys prefer seascapes to landscapes, and little girls prefer people to either; that children of both sexes prefer bright to dull colored

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pictures. It has been shown that girls below the age of fifteen give to cartoons a meaning different from that given by girls from fifteen to eighteen. They also evaluate them differently in terms of their funniness.

F. Sander, a gestalt experimentalist, advanced the notion that experiences organized around the unit of the face were more clearly differentiated by a viewer than were experiences organized against a neutral ground. He attempted to prove this conception of physiognomic organization by showing that the distance between two dots is much harder to estimate in its variations when the dots are presented against a ground of blank white paper than when they are made to represent eyes in a schematic face. One could go on at great length describing isolated bits of information that have been found to correlate with other bits.

I have attempted this very brief and incomplete sketch of attitudes, approaches and theories toward the concept of meaning in visual communication to suggest its historical longevity, its complexity and variability. I do not feel that these approaches have taken us very far, or that these theorists are asking the questions we should be most interested in answering, but I do think that such an outline offers us some clues that may help us to develop a more fruitful approach toward stating and solving the problems of film viewing and film analysis that face us today.

Although we are still concerned with the normative questions, they are now seen as social issues. Is violence in films good? Why are Hollywood films bad? In the analysis of films themselves and of pictures, the question of goodness or badness has for the large part been dropped. Similarly few of us today are willing to accept pictures and films as meaningless, or to analyze them as if they merely gave the appearance of meaning, or were an experience of God. The problems of interest today seem to be the substantive ones: to develop theories of meaning about visual communication; and to search for understanding of those processes of cognitive interaction that will help us to formulate the processes occurring when we see a film and when we infer meaning from it.

In the light of this discussion let us turn again to an examination of the process of film. Film communication can perhaps be clarified by the use of a conceptual framework that treats film as a process, and that separates the steps through which that communication takes place. This model should first of all allow us to describe the entire system in which film communication takes place—the maker of the film, the film itself, and the one who sees the film. It should contain the possibility of verification. The description should be clear enough to enable us to know how and where to test it. It should also have face validity, that is, it should correspond to what most people who make or look at films intuitively think happens during this process.

The process of film communication can be thought of as beginning with what I have called a Feeling-Concern. A person has a "feeling," the recognition of which under certain circumstances arouses enough "concern" so that he is motivated to communicate that feeling to others. I have purposely chosen words like feeling and concern that are vague and rather imprecise. After consideration of the entire model, it might prove valuable to try to fit the concepts that these words identify into tighter conceptual frameworks, but for the moment let us use the word "feeling" in the loose sense, by which we mean, "I feel that. . . ."

I use the word concern in the sense that the philosopher Paul Tillich uses it—"each man has his own concern, the ultimate concern is left for man to determine."

This Feeling-Concern then, this concern to communicate something, which many psychologists feel is almost a basic human drive, is most often imprecise, amorphous and internalized. It cannot be transmitted to another or even to ourselves in this vague, internalized, "feeling" state. With the decision to communicate, a sender must develop a Story-Organism—an organic unit whose basic function is to provide a vehicle that will carry or embody the Feeling-Concern.

The Story-Organism does not need to be a story in the usual sense of the word, but it may be. It is a collection, a set or a

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cluster, of "things" developed from the Feeling-Concern. I chose the word organism rather than such a word as element, structure, style or system because I want, first, to suggest the living quality and nature of the process that Story-Organism names and to suggest the quality of growth and development as it occurs in a human personality in the act of communication. Second, the use of the word organism suggests the biological concept of function by which most organisms are understood and by which we can examine the story organism, and third, it is meant to call to mind the concept of organization. All of these qualities, developmental, functional and structural, are meant to be implied at the Story-Organism stage of the process.

The Story-Organism mediates between the Feeling-Concern and the next stage of the process of film communication, the Image-Event. Before describing the Image-Event, it might be helpful to look at the Feeling-Concern and the Story-Organism in another light. Suppose we think of the Feeling-Concern as a belief that we want to communicate. We can think of a belief in terms developed by Rokeach as "a proposition we hold to be true which influences what we say or do. Any expectancy or implicit set is also a belief; therefore we can say that a belief is a predisposition to action." In this sense a Feeling-Concern is a belief about which we are predisposed to act. The Story-Organism can be thought of as the next step in that chain of actions. We do not always know, continues Rokeach, "what a person believes by any single statement or action. We have to *infer* what a person really believes from *all* the things he says and does. The organization of all verbal and non-verbal, explicit and implicit beliefs, sets, or tendencies would be the total belief-disbelief system." In this sense what I call the Story-Organism can be thought of as similar to the belief-disbelief system developed by Rokeach.

The Feeling-Concern then is a feeling—a vague, amorphous, internalized belief—that a given person at a given time is concerned or predisposed to act upon, in our case, to act upon specifically by communicating it. The Story-Organism is the organization into a system of those beliefs and feelings that a person accepts as true and related to his Feeling-Concern. It is the structuring of the many constituent units through which, and within which, his Feeling-Concern is clarified, organized and brought to life so that it can be externalized and communicated.

It is at this point only, after awareness of the Feeling-Concern and development of the Story-Organism (either consciously or unconsciously), that a given person, a film-maker, can begin to collect the specific external Image-Events that, when stored on film and sequenced, will become the film communication.

For the moment let's just define an Image-Event as a unit of film. We shall come back to it after we have finished describing the entire process. So far we have talked about the first half only. The sending process has been started. A film has been made.

I would like to suggest that the receiving process occurs in reverse order, as a kind of mirror image of the sending process. The viewer first sees the Image-Event—the sequence of signals that we call a film. Most often he knows nothing of what went on before. He doesn't know the film-maker and his personality, and he usually doesn't know what the film is about, or is meant to communicate. Should our viewer choose to treat these signals as a message, he will first infer the Story-Organism from the sequenced Image-Events. He will become aware of the belief system of the film-maker from the images he sees on the screen. From this awareness of the message he will, if the communication "works," be able to infer—to evoke in himself—the Feeling-Concern.

As you can see from this suggested view of the total process, the meaning of the film for the viewer is closely related to the Feeling-Concern of the film-maker. The single Image-Events of the film are the signals, these specifically sequenced Image-Events are what we treat as messages, and our inference about the Feeling-Concern of the maker is what we call the meaning of the film.

Ernst Kris, in his *Psychoanalytic Explorations in Art,* takes a somewhat similar view of the process. He conceives of art "as

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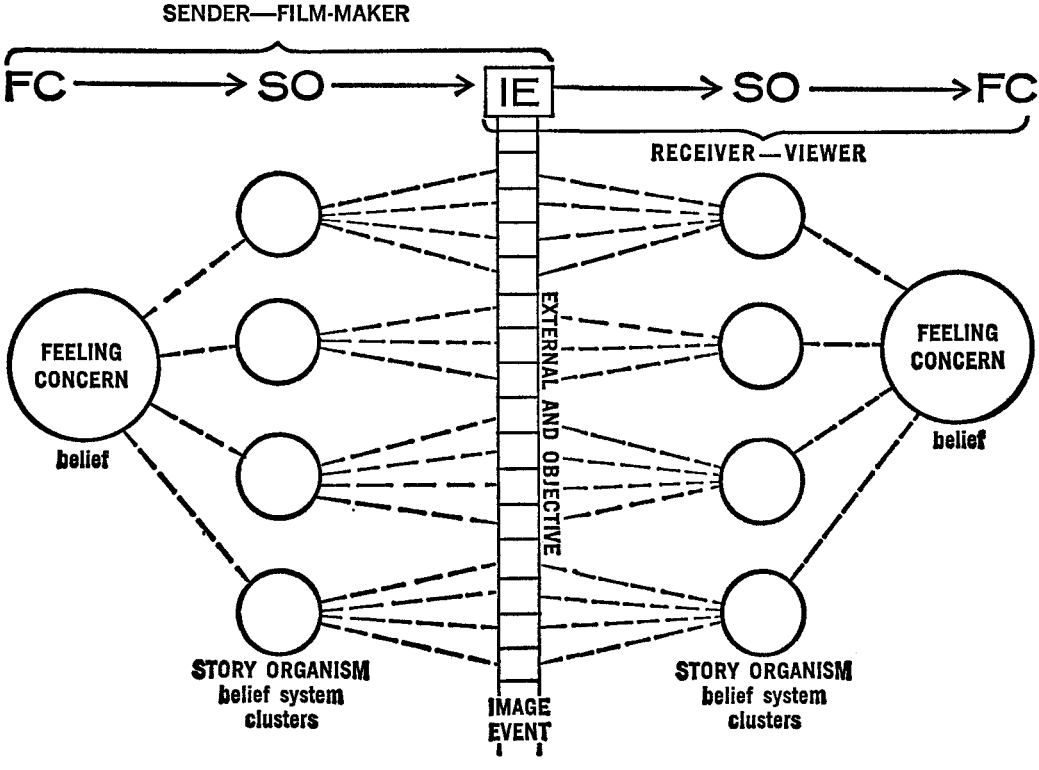
a process of communication and re-creation." Communication, he continues, "lies not so much in the prior intent of the artist as in the consequent re-creation by the audience of his work of art. What is required for communication therefore is similarity between the audience process and that of the artist." He deals at great length with the psychic processes that occur when the process of creation is *reversed* within the viewer. Kris suggests that this process proceeds from perception of the work on a conscious level to the understanding of the work on an unconscious level—reversing the sequence that takes place within the artist.

This model that I have suggested describes the process of film communication. It doesn't, however, explain it. In this concluding section I would like to examine this conceptual framework and explore some of the relationships contained in it to see if we can find some approaches to help us explain why, and how, what has been described happens.

The first notion that emerges quite clearly is the difference between the Image-Event and both the Feeling-Concern and Story-Organism.

The three terms on the left of the drawing can be thought to belong to the realm of the film-maker. The three on the right belong to the realm of the viewer. The Image-Event is the nodal point of the process. It is common to both film-maker and viewer—to both sender and receiver, creator and re-creator. The Image-Event is different from the other two terms, both as a part of the process for the film-maker and as a part of the process for the viewer. It is the only unit of this process that is directly observable.

The parts of the process that lead to the Image-Event and the parts of the process that lead away from it to the inference of meaning on the part of the viewer are internal processes which take place within the human being. The strip running down the page (like a strip of film) is our external objective Image-Event. The series of



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concepts across the top of the model describing a process represent our internal world.

In our original definition of communication we implied that the inference of meaning from a film was a function—a relationship—of something in the message and something in us. We can look at this model and see that it suggests two separate fields of study—two kinds of questions. The first revolves about the explanation of the human beings involved in the process, and the second about the explanation of the objective Image-Event that is the focus—the mediating agent—of the process. In order to explain the process of film communication we want to know what there is in the Image-Event that allows an individual to infer meaning from it—to recreate what was created. We shall, however, probably never be able completely to separate and distinguish between what is within ourselves and what is within the film that enables us to infer meaning from it. This particular area of study—the interaction between persons and groups, and the stimuli they relate to—has been undertaken by the social and behavioral scientists. Although relevant to our interests, the specific study of the relationships between people and events cannot be the professional concern of those interested in visual communication.

The study of the Image-Event, however—its properties, units, elements and system of organization and structure that enable us to infer meaning from a film—should be the subject of our inquiry, and of our professional concern.

Most of us who have thought about film and written about film have at one time or another used such phrases as the "language of film," "film grammar," "the syntax of film" and so on. We speak of the "language of dreams," the "language of vision," "the nonverbal languages." Most of us seem to share this desire to call film a language.

Although I am not sure that film is a "language," in the sense in which we define verbal language, my previous work in film and film research has led me to believe that an investigation of film *as if* it were a language offers interesting opportunities for its analysis and understanding. What follows, then, is not an attempt to prove that film is a "language" but rather a direction of inquiry into film as if it were a language—to see where it leads, and to see what paths this search will help to uncover.

The field of language studies, while historically starting with the examination of specific spoken and written languages and their changes over time, has now moved to the examination of *language behavior* encompassing many diverse interests and fields of study. As distinct from psychology, which takes as part of its area of study a concern with verbal behavior in the context of events occurring within the organism, and as distinct from the other social sciences that are to some extent concerned with the analysis of the contents of verbal behavior as it is relevant to shared cultural beliefs and actions, linguistic science has as its traditional subject matter the signal system as such, "the language as she is spoke."

In terms of our description of the process of film communication, the line going from the Image-Event down the page, representing the external Image-Event or film, would be considered the traditional field of interest for linguistic science. Although traditional linguistics has been divided into two main branches, the historical and the descriptive, they complement and are necessary to each other. The major effort, however, of linguistics in recent years has been to develop a system of units, elements and structure of a language that would enable one to describe that language.

The model that I have proposed and the earlier discussion revolving about the definition of visual communication imply an interest not only in the description of the signal system as such but also an interest in the relationship of the film-maker to the film, and the viewer to the film. In a sense the film is a mediating agent between two human beings engaged in an act of communication.

In the last twenty years a new science, or an offshoot of the older science of linguistics, has been developed, concerning itself not only with the descriptive and structural elements of language but with the internal human dynamics of language be-

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havior similar to the problems I have set forth in the line on my model running horizontally across the page—the line represented as internal process. This new science, Psycholinguistics, "is concerned in the broadest sense with relations between messages and the characteristics of human individuals who select and interpret them. In a narrower sense psycholinguistics studies those processes whereby the intentions of the speaker are transformed into signals . . . and whereby these signals are transformed into the interpretations of hearers."

It is within this linguistic and psycholinguistic framework that the hypothesis is advanced that film can be studied as if it were the "language" of visual communication, and as if it were possible to determine its elements and to understand the logic of its structure. Being forced to coin another word—one that sounds like linguistics but is different—I have called this area of study *vidistics* for two reasons: to make a distinction between the process of verbal and that of visual communication, and to preserve some of the connotations of similarity that do exist between these two modes.

Vidistics in this early stage is concerned, first, with the determination and description of those visual elements relevant to the process of communication. Second, it is concerned with the determination of the rules, laws and logic of visual relationship that help a viewer to infer meaning from an Image-Event, and the interaction of Image-Events in sequence. Film as if it were language, as studied vidistically, is thus thought of as the study of specified elements, elements in sequence, operations on these elements, and cognitive representations of them that act as a mediating agent in a communication process between human beings —between a film-maker and a viewer—between a creator and a re-creator.

The first problem then, in studying film in this way, is to formulate the units and elements that, when manipulated in certain ways by the film-maker and the viewer, comprise the system we will study as a language. This is no easy matter.

In a previous paper I have presented the attempts of many film theorists in the past to develop a system of units or elements by which film can be described, and I concluded that, although some of these theorists used phrases such as the "grammar of film," none of them developed a theory of film language embodying filmic elements or units capable of precise syntactic structure. No cohesive body of elements or units and operations has been formulated from which rules of structure, function and syntax can be observed and constructed. Rather than go into the specific elements and hypotheses about these elements in sequence that I have reported elsewhere, I would prefer to discuss some of the theoretical problems involved in looking at film as if it were a language, and to open up for examination some of the possible areas in which further research must be done before we can hope to have even the beginnings of a science of vidistics.

How can a film be analyzed as a language? If we must break it up into units or elements, how do we do this? In what specific ways is film language similar or not similar to spoken language? Are there different film languages as there are different spoken languages? Is there something about the grammar of film that is the same as spoken grammar? Does the notion of grammar or syntax occur in a similar fashion through a variety of film languages? Does the Whorfian hypothesis—that differences in spoken languages make for differences in our experiencing of the world—hold true for differences in language modes between the verbal and the visual? These and a host of similar questions become apparent when we look at film as language through the framework I have presented here.

The very notion of breaking a large thing into its constituent pieces is a complex one. The "pieces" into which a language can be divided are as numerous as the ingenuity and number of the investigators. For example, if we use as our illustration spoken language, we can break up a conversation between two people in some of the following ways. We can start by dividing the utterances into those uttered by each person. We can divide each person's utterances into what we know to be paragraphs, sentences, words, syllables and

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single sounds. We can divide the utterances into verbs, nouns, adverbs and so on. We can divide them into declarative, interrogative or exclamatory sentences. We can divide the utterances into large words or small words, into words beginning with vowels or consonants, or even into words that begin with specified letters of the alphabet.

What all these divisions have in common, however, is a known group of concepts and categories for organizing utterances. We already know how to define and distinguish among a noun, a verb, a word, a sentence and a syllable and even the utterance of one man from that of another.

Grammarians and linguists are not only involved in constant classification of units, but are constantly concerned with which method of classification and categorization is most efficient and effective. Recent studies in the "new grammar" have shown concern over the relevance of even these forms (noun, verb, *et cetera*) of grammatical categorization and organization.

In the study of visual communication and of film, no such comprehensive set of categories exists. We share the concern of the investigators of verbal language but lack the backlog of comprehensive work that has been done on oral and written language.

I have up to this point used the words "unit" and "element" almost interchangeably referring to the pieces we divide things into for study. Actually, "unit" and "element" refer to different ways of dividing a thing. According to Vygotsky, the method of breaking complex psychological wholes into elements is comparable to the chemical analysis of water which breaks it into hydrogen and oxygen. He finds this method inadequate for the study of language processes. "Neither of these (hydrogen and oxygen) possesses the properties of the whole and each possesses properties not present in the whole. The student applying this method in looking for an explanation of some property of water—why it extinguishes fire, for example—will find to his surprise that hydrogen burns and oxygen sustains fire."

Vygotsky suggests instead an analytic *unit* for the study of language phenomena. By unit, he means a product of analysis that retains all the basic properties of the whole and that cannot be further divided without losing them. "Not the chemical composition of water but its molecules and their behavior are the key to the understanding of the properties of water. The unit of biological analysis is the living cell possessing the basic properties of the living organism." He feels that the unit of analysis for language is, therefore, the word and the word meaning. He says, "The nature of meaning as such is not clear. Yet it is in word meaning that thought and speech unite into verbal thought. In meaning, then, the answers to our questions about the relationship between thought and language can be found."

It would seem that the concepts of word and word meaning were obviously the starting places for language units. Yet in verbal language studies, "the word as a unit occupies a paradoxical position." No generally accepted and satisfactory definition exists, and some linguists deny the validity of the word altogether. Although we all seem to know what "word" means, linguists have had a difficult time trying to define it in such a way that when we hear a new and unknown language we can apply a set of rules to determine a "word."

In this sense, film can be thought of as a new and unknown language. What would the "word" of a film be? Some theorists of film, starting with Eisenstein, suggest the shot as the basic unit. But this poses many problems. I have suggested elsewhere that the shot—an unbroken length of film depicting a continuous Image-Event—can be broken down into the *cademe*, or camera shot, and the *edeme*, or editing shot, certainly a distinction that must be made. But which of these is the basic unit: The length of film that is taken in the camera—the *cademe*—or the length of film that is used in the final film? I suggest the *edeme*, the unit of film that is constructed from the camera shot, since this is the unit that, when combined in sequence, seems to produce the larger unit that we call a film, and that we might think of as a sentence, a paragraph or a book.

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If, on the other hand, the *cademe,* the camera shot, is thought of as a unit, it would be the "word" from which other words are made. Going back again to our analogy with verbal language, there are a finite number of sounds from which we make up the words of any language. In English the twenty-six letters of our alphabet crudely represent these sounds. If the *cademe* is the unit, then the number of possible units (analogous to sounds, and to an alphabet) becomes almost infinite, since the number of images we can photograph is almost infinite. If, on the other hand, the *edeme*—the editing unit made from the camera shot—becomes our unit, the number of *edemes* that can be constructed from one *cademe* is quite small.

The fact that a verbal language has a comparatively small number of sounds from which a large number of word units can be constructed—a sort of building block system—is one of the defining characteristics. The fact that visual language, and film language in particular, has an almost infinitely acceptable number of images creates either a challenge to the concept of building blocks as a requisite of language or the possibility that images as they exist in film can constitute a language. The problem of defining a unit with which to describe film therefore becomes of paramount concern, because upon the unit will fall the responsibility of organized structure in coding a message for the sender and in decoding for the receiver.

The second concept of extreme importance in language is the notion of grammar or syntax. Again let us look at the concepts developed around the study of verbal language. Noam Chomsky of the Massachusetts Institute of Technology, one of the leading linguistic theorists working today, considers a language to be "a set of sentences, each finite in length and constructed out of a finite set of elements. All natural languages are languages in this sense, since each natural language has a finite number of phonemes (or letters in its alphabet) and each sentence is representable as a finite sequence of these phonemes (or letters), though there are infinitely many sentences." This concept of grammar, Chomsky asserts, can be tested scientifically for, "the grammar of language L will be a device that generates all of the grammatical sequences and none of the ungrammatical ones."

The way to test this notion is first "to determine whether or not the sequences that it generates are actually grammatical; *that is,* acceptable to a native speaker." This can be tested by taking sentences that a native speaker holds to be grammatical and seeing if the grammar we have developed can explain and decide what is indeed grammatical. The same should hold true for a sentence that the native speaker holds to be ungrammatical. Furthermore, Chomsky has shown that this notion of grammar or syntax should apply regardless of the semantic meaning of the individual words.

He gives the following two sentences, composed of the same words, as examples to illustrate the notion that judgments of grammaticalness occur regardless of the semantic meaning of the units in sequence. The sentences are equally nonsensical, but any English-speaking person will recognize one as grammatical.

(1) Colorless green ideas sleep furiously.
(2) Furiously sleep ideas green colorless.

Let us take these definitions and try to translate them into film language. A sentence is constructed out of a finite set of elements. What we are looking for is a logic, a system, a set of rules or definitions by which we can determine units and their sequence in order to know how we infer a meaning from them. "Dog bites man" and "man bites dog" mean different things. We know this because we know the units (words) and we know that the difference in their position (sequence) implies a different meaning for the larger unit (the sentence). We know about the system of meaning inference, so that we can say that the first word denotes something (an action described by the second word) that is acting on the object described by the third word.

If we consider the *cademe* as a unit, which is finite, what could constitute the filmic sentence into which the *edemes* made from that *cademe* will go? If we consider a sentence as a group of *edemes* made from a *cademe* (which is finite) we have the prob-

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lem of defining a sentence. How many *edemes* made from one *cademe* are a larger unit (a sentence)? Even if we could arbitrarily determine this, we are still faced with the system—the grammar. How do we define a unit, large or small, whose rules we can describe in such a way that we can distinguish between what is a grammatical sequence and what is an ungrammatical sequence?

I find it almost impossible at this point to construct a sequence of shots that an audience will say is ungrammatical. Nor can I find a sequence of shots that I or a particular audience can say is grammatical. If no one can distinguish between grammatical and nongrammatical, we have to give up either the concept of grammar in film, or the concept of grammar as we know it—which is a grammatical-ungrammatical polar entity. In the entire literature on film, I cannot find anyone who can make such distinctions. Yet I am not satisfied to say that the concept must be discarded. The answer, it seems to me, lies in a deeper understanding of the concept of syntax as it applies to visual Image-Events in a vidistic structure. The answer must lie somewhere in a fuller understanding of the units and combinations of units that humans are able to relate and to infer meaning from—or to re-create. I suspect that the notion of a semantic space having dimensions of meaning such as that developed by Charles Osgood can be extended to the notion of grammar in visual language.

We would then have to develop a grammar of probability, a system of possible, of more or less meaningful, sequences based on a concept of dimensions of syntax. Just as we now accept the idea that there is not *a* single meaning in a poem, a dream or a concept, we would have to accept the idea that there is no absolutely grammatical sequence or ungrammatical sequence. Syntax seen in such a way would be governed not by laws of Aristotelian logic but perhaps by a form of psycho-logic determined by cognitive processes that all human beings share, or by a psycho-logic that is culture-bound and determines whether we speak one visual "language" or another.

The tie between the semantic meaning of images in sequence and the syntactic meaning of the sequence itself will have to be much more fully understood. When a little girl says, "me go up," we know it is ungrammatical, but we also are able to infer meaning from it. When she says, "me go brown" it is just as ungrammatical, but I can infer less meaning from this statement than the other. The problems involved in analyzing film sequences are of this nature rather than like the problem posed by Dr. Chomsky in his "colorless green ideas sleep furiously."

This problem of a syntax, structure or organization of visual language must be solved before we can even attempt to handle the problems of "word" meaning that Vygotsky attempts to solve in his work. All of us are anxious to get to the point where we can relate the structure of film "language" to the semantic, imagistic, metaphoric meaning of an individual unit of film, and of a complete film. The film is akin to a complex poem, but composed of units that are even harder to define than words. Until we know more about the visual "word," until we can at least deal with the image as we can with a combination of sounds in any verbal language, and handle such statements as "That is not a word in this language," we cannot truthfully say that we can understand and analyze the film process.

At this point the area of interest that I have presented amounts to a prolegomenon for a new field of study—vidistics. I have presented more questions than answers, more problems than solutions. But perhaps this is just as well. These are the problems that it seems worthwhile to explore.

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Re: Vision

STAN VAN DER BEEK

Vision undergoes re-vision; intention, symbol, reality
are the factors that undergo constant change
in the appearance of any art form.

Motion pictures—
pictures in motion—
seem most suited to the metaphysics of change,
to life in motion,
and as such cinema is becoming the most significant of art forms.

> "One thing that is new is the prevalence of
> newness, the changing scale and scope of change
> itself, so that the world alters as we
> walk in it. . ."
> (Robert Oppenheimer, from "The Open Mind")

I like to think that life is a dissolve. . .

. . . and that seeing is the real illusion, that a sense of reality
is a sense of the senses. . .
that a sense of reality is a sense of non-sense. . .
that movies should delight the eye and rearrange the senses. . .
that movies are changing the art of seeing. . .
that movies are an art of seeing. . .
that movies are an illusion. . .
that seeing is believing.

The irony of art and life reminds us that "motion pictures"
are really a series of "still" pictures, which are being replaced
in the projector at less than 1/24th of a second . . . reaching
our eye at 186,000 m.p. second.
That we see the illusion of motion is based on the retention
of image, or the eye's inertia.

Motion pictures are apparent motion. . .
The film worker deals with "visual velocity" and "visual inertia,"
laws of sight that seem similar to laws in physics—
or at least to definitions of sight that contemporary
artists are exploring.
If movies and "vision" can assume the same meaning
then visions take the path of least resistance, that is,
intuitive logic, intuitive geometry, image-symbol making, art-
city planning of the mind, a form of research
that is just beginning in motion images. . .

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(Retinal art such as strobiscope stimulation that produces colors from black and white images . . . the possibility of mental movies. . . .)

> "If confusion is the sign of the time, I see at the root of this confusion a rupture between things and words, between things and the ideas and signs that are their representation. . ."
>
> (Artaud)

The apparent image and the approximate image interrelate in our national sense of photo-reality. It is not inappropriate that we have a magazine called "Life"—that we take for granted that movies are reality. . .

That we take for granted much of our American life as it is reflected in photo-reality is evidenced by a lack of self-criticism and satire. . . .

> Paul Klee said:
> "Satire is not an excess of ill humor, but ill humor resulting from a vision of something higher . . . ridiculous man, divine God. Hatred for anything stagnant out of respect for pure humanity. . ."

Malraux pointed out that life has no real walls . . . and no real museums. . .
The World's Fair is an example:
It was not very interesting to people, and was a commercial failure, perhaps because it was designed as an object in the museum tradition. . . .

But if it had been designed as objects, books, textures, smells, sounds, motion pictures, that were sent in boxes to each person in America to own and keep in his possession. . .
to give each of us continuous research pleasure and the stimulation of international ideas. . .
a direct 20th-century stimulus made possible by mass production, that would serve as reference material until the next Fair. . .

In other words a kit of communication tools sent to 150,000,000 Americans—projectors, tape recorders, books, slides, films, display cases, *et cetera*—designed by the artist designers of the world, mass-produced so that the budget for this kit would cost no more than a pavilion's installation.

Since one had to pay to get into the Fair, the citizen could have sent this money in return for the kit. For a suitable time period the Fair would have sent him continuously changing displays

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and materials from all over the world . . . some to keep and some
to exchange, like books from a world library.

The World's Fair was at best merely fair. It reproduced the
ideas of 1939, not 1964 . . . It could be
anticipated that audio-visual conditioning will produce new results. . . .

I like the process of making films, because it is a way for me
to have dialogues with myself.
I work in a small studio-dome, which I built myself from a silo
top.

I work in the painter's tradition and do everything by
myself as much as possible, which includes home development
of my negatives, camera work, editing, *et cetera*. . .

I often make my films without too much conceptual preparation,
using the film process of animation itself as a means
of note-taking.
Thus in the making of one film, a process or idea for another film
often comes about.

I also like to work on a variety of films at the same time
(often as many as six) and don't expect to see a finished
film for several years. . .

Editing a film, often inter-editing from one separate film
into another, continues the conversations with the self. . .
Cinema, like significant painting, must be made on
the basis of self-expression and necessity. . .
There are no geniuses in film-making, only desperate
men. In my opinion the audience cannot be considered as the final
target for their film work, but it may be implicated. . .

The major failure of commercial films made by the film "industry"
is that they represent the range of public-accepted vision that
cannot be made private . . . whereas the film poet is confronted
with the dilemma that his private vision can in no way be made
public. . .

Motion pictures are just now beginning to come out of the literary
perspective of the novel and staged drama they were born in. . .

It is interesting that after nearly 400 years of art that was
preoccupied with realism—growing mostly out of the theory of
perspective and its effect on the senses—this preoccupation
has at last reached its ultimate form in photography, particularly
motion-picture photography.

It is part of the interesting nature of art that at this same
juncture in the crossroads of art, with the perfection
of a means to capture exactly perspective and "realism,"

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the artist's vision is turning more to his interior, and in a sense to an infinite exterior (photos of Mars), abandoning the logic of aesthetics and springing full-blown into a juxtaposed and simultaneous world that ignores the one-point-perspective mind and the one-point-perspective lens.

Another factor of particular interest is that movies represent a kind of international decompression chamber, being the only international art form that is portable, reproducible and universal in popularity. . .

I am fascinated by one of the current theories about dreams which holds that dreams are a way for the body to get rid of body poisons (which get burned up in the dream-act).

If this holds true, it seems likely that motion pictures might be a way for us to burn up international and national "toxic" attitudes. Perhaps this is an aspect of the moviegoing ritual, and of the value of the Hollywood "dream factory". . . .

Clearly, movies help us to re-experience our experiences, which seems to be a basic human need.

Motion, metamotion, kinetic identity, body-motor response, homeostasis, continuity. . .
the movement of the spheres. . .
are to be pinned like a moth stuck in the axis of the mind,
to relieve the tensions of change (doubt)—of the movement of life itself—by studying it. . .
by changing it into a symbolic form that is as real and meaningful as life itself.

I have emphasized that motion pictures are the unique art form of the 20th century,
that they have produced a revolution in worldwide aesthetics,
(namely, that motion pictures have produced the new aesthetics of anticipation, as compared to the older idea of painting and art history as "meditation"). . .
that cinema is just beginning to come into its own. . .

The future holds unknown combinations of some of the present loosely knit ideas. . .
integration of cinema, theater, dance, drama, electronic sound and sights, movie-dromes, video tape, libraries of film, kinetic and "expanded" cinema, "movie-murals," "movie-mosaics" . . .

Some of the ideas that are of particular interest to the current film-maker are:
simultaneous images and compression,
abstractions, superimpositions,
discontinuous information,

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social surrealism,
episodic structure,
loop film (continuous projection),
film as a reflection of private dreams, hallucinations. . .

Some of the vastly expanded techniques available now include:
8mm (some 6½ million 8mm cameras in America)
super 8mm
16, 35, 70, 120mm (over one billion dollars for photo-services annually),
video tape for home use,
computer-generated graphics,
stereo and laser pictures. . .
television (4½ hours viewing-time per average family per average day).

The contemporary artist, facing many opportunities in America, must find ways to cut across definitions and precensorship of techniques and medias.

The artist must make use of the force of art, with its influence on human psychology, to communicate and to announce. He must find ways to come out of his isolation from his community. He must find ways to unite technology and the human condition. . .
He must find ways to investigate, to document, to decorate, to criticize, to love . . . and so add meaning to the life we are all shaping.

My own work leads me into multiprojection and the building of the "movie-drome" in which I plan to develop a sight and sound research center, a prototype theater of the future, exploring motion pictures, image transmission and image storage, video graphics, electronic sound and music, drama and experimental cinema-theater.

I foresee motion pictures as the tool for a new form of world communication (via satellite) about to open the future of "ethos-cinema."

We are on the verge of a new world—a new sense of art, life and technology—when artists shall deal with the world as a work of art, and art and life shall again become the same process. When man's senses shall expand, reach out, and in so doing shall touch all men in the world.

In my view I see that art and life, man and technology, unite and seek to renew and re-view. . .
In particular I see that motion pictures will become "emotion-pictures" and will generate into a new structure, a new context, becoming a nonverbal international picture language, in which we can talk to each other. . .

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More important, inter-culturally, art and life
must do something about the future; the world is hanging
by a thread of verbs and nouns.

I see that certain films, made in a certain way and presented
in a certain way, will help us and will be used as a technique
to understand and balance the senses.

The development of a nonverbal international picture
language that makes use of cinema and other image-
transmission systems is of utmost importance in the
consistent crises of world peace.

But to realize the possibilities of this new art form
(cinema is only approximately sixty years old) many more
artists and poets must become aware of this media and
attempt to work with it.
I hope that artists from all over the world will do so
and quickly, so that we can realize and enjoy our differences
in a "Culture-Intercom."

Sights and sounds, the changing illusion of the world in which
we live, and the world that lives
only in the mind, are the basic materials of film creation.
The full flow of color, sound, synthesized form, plastic form, light and
picture poetry have in no way begun to be explored in man's
range of experience.

✪ STAN VAN DER BEEK, who trained as a painter, has been active in experimental film-making since 1955 and is currently teaching film production at Columbia University. This is another of the Vision 65 speeches.

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Introducing Coenetics

A Biosocial Analysis of Communication

ROGER W. WESCOTT

Gobbledygook: Mine and Thine

What is Coenetics (pronounced "se-NETT-ix")? As is suggested by its etymon Greek *koinoo,* "I communicate," from *koinos,* "common," it is the study of communication. For this discipline, one may ask, why not use the more familiar and far more transparent phrase "Communication Theory"? To this objection there are two answers. First, "communication" is denotatively ambiguous, in that some writers use it broadly to cover the study of all signaling systems, while others use it narrowly as a synonym for Information Theory, the science of "intercom systems" and "information load." Second, it is connotatively ambiguous, in that to many scholars it suggests Madison Avenue and the manipulative approach to research from which they shrink.

Why, then, should we not use Professor Norbert Wiener's term Cybernetics, meaning literally "steersmanship," and functionally defined by its originator as "the science of communication and control"? Are not Cybernetics and Coenetics so nearly synonymous terms as to render one of them—presumably the latter one—otiose? The answer here, I think, is that, despite a vast overlap of field between the two disciplines, their centers of gravity are so far apart as to make competition between them negligible in practice. For despite Wiener's broad erudition and avowed humanitarianism, his central interest appears to be in the application of mathematics to engineering. More specifically, it lies in constructing "thought machines" capable of parlaying feedback into a quasi-organic sort of creativity—without, at the same time, permitting them to become Frankenstein monsters. My own interest, on the other hand, follows my training, which is primarily in social science, with considerable overlap into the humanities and life sciences but comparatively little into the physical sciences. My chief objective is to relate prelinguistic communicative systems to language itself and both to such language-derived systems as arts and letters. In brief, then, however much actual subject matter they may share, Communication Theory inclines toward a statistical, Cybernetics toward a mechanical, and Coenetics toward a biosocial interpretation of communication problems.

Communication and Communism

Enough said on the etiquette of innovation. If Coenetics is the study of communication, all we need to do to grasp it is define communication. Here lexicography can help us.

The English word *communication* was borrowed, during the early Renaissance Period, from Classical Latin *communicatio,* "sharing"—which was itself derived from Latin *communis,* "common." This latter word, in turn, came from the root of Old Latin *moenus,* "service." Indo-European cognates of these Latin words are Lithuanian *mainas,* "barter," and Sanskrit *menis,* "revenge." All these terms can be traced to a reconstructed Proto-Indo-European stem **moyn-,* "repayment," from a root **mey-,*

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"to reciprocate" (whence Sanskrit *mayate,* "to exchange").

Historically, the English word *communication* seems to have had seven major and discriminable meanings:

1. conversion	1462
2. eucharist	1549
3. charity	1579
4. coitus	1642
5. information	1690
6. connection	1715
7. transmission	1862

In current English, there are three groups of cognate words from Proto-Indo-European **moyn-*, which exhibit the stem-forms, *mean-, -mon-,* and *-mun-,* respectively. The first of these, derived from Old English, contains the adjective *mean,* "pernurious" or "nasty," whose older signification was apparently "common to all" and hence "vulgar." The second, derived from Old French, contains the adjective *common.* The third group, derived (often through later French) from Latin, includes the verbs *commune* and *communicate,* the adjective *communal,* and the nouns *communion, community* and *communist.*

Communication as Contact

For our purposes, however, communication will be defined as broadly as possible as any kind of interagent contact, ranging from the collision of subatomic particles to a witty, subtle and graceful exchange of ideas and sentiments among mutually congenial conversationalists. It may be objected that this usage is far too inclusive to be manageable and that we should, pragmatically at least, make a more or less arbitrary cut at some point between these extremes, calling all behavior on one side of this "communicative" and on the other side "noncommunicative," and excluding the latter from consideration. Rather than adopting such an all-or-none procedure, however, I would prefer to take the two aforementioned extremes as polar cases, representing maxima and minima, respectively, and ranging most communicative behavior somewhere between them. In other words, I propose to substitute a gradient scale for a series of pigeonholes, thereby retaining precision while increasing correspondence to reality.

In these terms, minimal and maximal communication contrast in roughly the following ways:

Minimal Communication	*Maximal Communication*
1. inorganic	organic
2. unspecialized	specialized
3. destructive	constructive
4. noncooperative	cooperative
5. one-sided	mutual
6. unconscious	conscious
7. automatic	optional
8. accidental	intentional
9. ambiguous	explicit
10. undifferentiated	many-leveled

In addition to its timeless aspect, the contrast between maximal and minimal communication also has a diachronic aspect, since maximal communication has gradually evolved from minimal communication over a period of about three billion years. The stages in this evolution are listed sequentially in the diagram on the opposite page.

The nineteen developments detailed there may be grouped into five major steps (or, in Communist parlance, "great leaps forward"). The first of these, which probably took place during the Archeozoic Era of the earth's history, consisted of self-replication and differentiation of structure within the individual cell. The second step, which probably took place during the Proterozoic, consisted of the clumping of cells to form multicellular organisms and of multicellular organisms to form colonies of physically interconnected individuals. The third step, which took place by the Paleozoic, consisted of the development of structures for the transmission and reception of signals between animals spatially distant from one another, such as the stridulatory organs and the antennae of insects or the larynxes and the ears of land vertebrates. This distal capacity then enabled the higher animals to form communities of various sorts—schools, flocks, herds, families and societies. The fourth step, which took place in the Cenozoic Era,

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consisted of the development, among warm-blooded land vertebrates, of a social heredity, or tradition, taught by older animals to younger animals in multigenerational communities. And the fifth step, which took place during the Pleistocene Period, or Ice Age, was the development of language itself—a technique of building meaningful forms from meaningless sounds —with all the arts, scripts and mass media that have grown out of it.

Man, the Psychotic Ape?

It would be too much to say that human life is less orderly than hymenopteran life. For men no less than for ants, communication is coordination. But cultural order is far less predictable than purely social order; and for that reason it would probably appear, from an ant's eye view, insane. A complementary observation is now being made with increasing frequency by perceptive psychologists who have begun to discern rich and far-ranging, although intricate, regularities in the fantasy-structures of psychotics. All of this may even lead us to suspect that schizophrenics, for example, are "precociously demented" only in the sense that they are vainly attempting to communicate with our retarded humanity in a psychic code that may not become prevalent, and therefore tolerable, until ages hence. Their order may already be cosmic in scope—as, indeed, they grandiloquently proclaim—while ours remains primevally earthbound.

To revert, however, from the realm of prophecy to that of history, perhaps we can, for the nonce at least, learn more about that most human of all communicative systems—language—by retrospect than by forecast. The long-standing philological ban on speculations concerning the origin of language is now, however, hesitantly being lifted; and, armed with the recent findings of ethology and somatology, intrepid ethnolinguists like Charles Hockett of Cornell University are venturing back into what was, for fifty years, forbidden territory.

According to Hockett, language has thirteen "design features" setting it off from less highly evolved communicative systems. Because his terminology is intricate and his features overlap broadly, I here condense them into four coenetic syndromes:

1. *vocalicity:* the message, produced by larynx, is received by ear; although it can be re-

STAGES IN THE EVOLUTION OF COMMUNICATION

Development	*Era*	*Period*	*Years Ago*	*Example*
genetic code	Archeozoic		3 B	viroids
clustering			2 B	bacteria
sexuality			1.5 B	ciliates
clumping	Proterozoic		1 B	volvocids
colonialism			700 M	sponges
distalism	Paleozoic	Cambrian	500 M	trilobites
congregation		Ordovician	450 M	fish
courtship		Silurian	400 M	nautiloids
parentalism		Devonian	350 M	scorpions
vocalization		Carboniferous	30 M	amphibia
familialism		Permian	250 M	beetles
society	Mesozoic	Triassic	200 M	termites
genetrarchy	Cenozoic	Eocene	60 M	deer
tradition		Miocene	30 M	crows
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ceived by anyone within earshot, it fades out rapidly.

2. *symbolicity:* the message, being in an arbitrary code, bears no systematic resemblance to its referent; the auditor can transmit as well as receive the message; and the message is specifically communicative in intent, not a mere reflex of reproductive or self-preservative activity.

3. *preceptivity:* the message is part of a system that can be taught as well as learned; it involves displacement, or the capacity to refer to things not immediately perceptible; and it creates tradition, a social inheritance that can be lost as well as acquired in a generation.

4. *productivity:* the communicative system can generate new utterances that, although never heard before, are yet fully comprehensible; it is characterized by particulation, or the possession of minimal units (like the letters of the alphabet) that, although meaningless in themselves, can be used to construct meaningful messages; and it exhibits discreteness, or sharp functional contrasts between its units, which, even when acoustically similar (as p is to b), nonetheless so operate as to make auditors respond to words like *pit* and *bit* as to wholly separate utterances.

Of these four syndromes, only the last—productivity—seems to me to be uniquely distinctive of language. But this uniqueness has been sufficient to make language itself a uniquely creative signaling device, providing man with a uniquely creative culture. Of course, there is a destructive as well as a constructive side to man's creativity. For man differs from the God of Genesis in that he cannot shape the void but only previously existent creation. And early man probably fractured the rugged repertory of anthropoid cries worse than Americans fracture French, to produce that vastly more flexible if fragile mechanism we call language. Yet this need not be in any sense an indictment. For the insect pupa decomposes the larva to recompose it as a thing of swift beauty, the imago. And if man lacks the omnipotence, in Gordon Childe's phrase, to "make himself," at least he has shown the imagination to reconstitute himself.

Nonlinguistic Communication

Still, all higher organisms carry traces of their evolutionary past, and to this rule man is no exception. In fact, in at least one regard, he obeys it doubly. For not only do most of the features of language have patent animal ancestry, as Hockett points out; but man also retains, more or less intact, several nonlinguistic communicative systems. These systems are succinctly graphed in the following diagram:

TYPES OF BIOSOCIAL COMMUNICATION

type	*subtype*	*infratype*	*discipline*
proximal	physical	tactile	haptics
		thermal	thermotics
	chemical	gustatory	geustics
		olfactory	osmology
distal	visual	kinesic	kinesics
	auditory	strepital	strepitistics
		phatic	phatics
		linguistic	linguistics

Of these systems, the first one to be named and systematically described is *kinesis*, the subject matter of the discipline which Ray Birdwhistell created and called Kinesics. Kinesics is the study of communication by means of visible body motion, including facial expression. Kinesis, therefore, differs from language in at least two respects—that it is nonauditory and nonvocal—and may differ additionally in being nonproductive.

The next communicative system to be isolated and investigated is that of nonlinguistic vocalization, the nomenclature of which remains unsettled. Weston LaBarre, following Malinowski, calls it "phatic communication." H. L. Smith terms it "vocal modification." And A. A. Hill, as quoted by G. L. Trager, suggests "paralanguage." My own preference is to follow LaBarre but to telescope his phrase "phatic communication" into the single word "phasis," the study of which becomes "phatics." In any case, the most striking

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difference between phasis and language is that phatic utterances (which I call "phemes") cannot be analyzed into distinctive particles or arranged in larger constructions. In a word, phasis lacks productivity.

A third area, which has not yet received explicit recognition even from students of communication, is what I have christened strepitistics. Strepitistics is the study of strepitus, or communicative body noise. (Putting it another way, kinesis and strepitus are types of body movement distinguished chiefly by their modes of communicative reception, the first being visible and the second audible.) Typically strepitative behavior is hand-clapping. Peripheral examples of strepitation are: foot-stamping, which involves contact with the ground or with artificial flooring; face-slapping, which requires the presence of another person; tooth-gnashing, which involves bony parts most of which are not so located as to facilitate phonation; whistling, which employs speech organs; spitting, which includes extrusion of body secretions; coughing, which may indicate pathology; and snoring, which is usually unconscious.

Recapitulating then: phasis stands closest to language and kinesis furthest away from it, with strepitus in an intermediate position, logically speaking; since phasis is both audible and vocal, strepitus is audible but not vocal, and kinesis is neither audible nor vocal.

Of the four communicative systems we have been discussing, only one—language—appears to be restricted to man. Phasis, in fact, seems to be the primary means of communication among most terrestrial vertebrates: only lower amphibia, such as salamanders, lack it. Strepitus, on the other hand, is most in evidence among the homopteran and orthopteran insects (cicadas, grasshoppers, *et cetera*), which attract their mates by stridulation—a high-pitched sound produced by rubbing their legs against their wings or abdomens. Kinesis is effective only among those animals that have developed visual acuity, such as the vertebrates (for example, fish), the insects (for example, wasps), and the cephalopods (for example, squids). Among the members of at least one insect group, the honeybees, kinesis, in the form of the so-called "honey-dance," is the most factually informative type of communication engaged in, even though chemical communication is probably more vital for ensuring their social solidarity.

From Phasis to Language

The recent revival of interest in cultural evolution among American anthropologists leads one to ask how human evolution correlates with the development of communication. I would hazard that language is a product of the Upper Pleistocene Period, and that such early hominids as Transvaal Man and Peking Man relied chiefly on phatic signals for communication. My reasons for suspecting this are two: First, the few linguists who have sought prehistoric "vanishing points" at which all extant language-families converge in a single family, have never found the point of convergence to be more than fifty thousand years old. And second, the stone industries of Lower Paleolithic hominids were so nearly changeless across continents and millennia as to make it suspiciously likely that their culture was genetically rather than socially transmitted, so that language was not required for their instruction in either tool-manufacture or tool-use. Neanderthal Man and Modern Man, however, had a plurality of tool-styles and rituals which varied so markedly with small shifts in time and place as to make it improbable that the variations could have been other than linguistically mediated. We might say that, although the pre-Hominians had culture, only Homo himself has cultures, and that while Primitives evolved techniques, like fist-rocks and firebrands, it took Sophisticates to conjure up ideologies, such as art and religion. For only after the ape-man had learned to shape tools could man learn to shape himself.

Yet the question remains how language evolved from phasis. Here the Victorian "yo-he-ho" and "pooh-pooh" theories are little help, because what they really explain is not language but phasis. My own

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guess is that the Australopithecines of South Africa may have taken the first step toward human communication by simply extending the simian repertory of ten to forty phemes into the hundreds, much as they extended the range and power of their limbs by the use of sticks and stones. This early repertory may then have been still further swollen by a Pithecanthropine increment of nature-imitative phemes, rather as the rare brushfires of nature were supplemented and outnumbered by the life-sustaining campfires of early East Asians. If so, mutual response was already less a case of "monkey see, monkey do" than of "baby hear, baby say."

By the Middle Paleolithic Period, however, the prehominian phatic "lexicon" must have been nearing an impasse, in that further discriminations between increasingly similar utterances were becoming all but impossible. At this point, some sort of functional breakthrough was needed before further communicative advances could be made. It was provided, Hockett conjectures, by the repeated coincidence of two accidents—an unintentional blending of two semantically similar phemes (for example, "Dop!" from a speaker hesitating between "Don't!" and "Stop!") on the part of some vocalizer, and an equally unpredictable but fortunate comprehension-response from one or more auditors. This process became productive, presumably, when it became deliberate, as in the case of the English verb *bash* (first attested from the year 1641), coined by a crossing of the older verbs *bat* (1205) and *mash* (1000).

In a sense, therefore, we may say that language was born of a breakdown in the phatic system—a failure to keep phemes whole and distinct. But for the hominians it was a blessed failure. (Furthermore, this particular example of the paradoxical achievement of "success through failure" is far from unique in evolutionary history. For the most plausible explanation yet proposed for the origin of multicellularity and of sociality is that both were the outcome of failures—in the first case, failure of fissioning bacteria and protozoans to separate after fissioning and, in the second place, failure of young insects and mammals to leave their parents and siblings upon attaining maturity.)

Neanderthal Man, then, was probably not only a culinary carnivore like his forebears but a two-fisted walkie-talkie as well. And, to judge by his bear-cave skull-sites, he doubtless invested his newfound power with supernatural significance and began weaving spells over himself and his world, some of which we have yet to throw off. When Cro-Magnon Man added art to magic, he began painting powerful pictures and (we may surmise) chanting irresistible incantations as well. At this point music may well have begun to have that feedback effect on speech that the proponents of the "sing-song" theory of language origination presumably envisaged.

Communicative Reform

It has long been a tenet of psychoanalysis that all psychosomatic symptoms are communicative, however difficult it may be to decipher their messages. In some cases these symptoms seem to be prelinguistic in nature, as in the case of false pregnancy. In others, they seem to be language-derived, as in the case of one type of chronic gastritis, which may be a translation of such figurative colloquialisms as "bellyaching" into literal bodily terms.

Of all symptoms, of course, dreams are those that most peoples have always felt to be most revealing. The Talmud, in fact, called an uninterpreted dream "an unopened letter." But it was not till 1959 that William Dement, a psychiatrist at Stanford University, performed electronic experiments demonstrating that dreaming itself serves an even more indispensable psychic purpose than does dream-interpretation. He showed that if subjects are carefully prevented from dreaming, then, no matter how much dreamless sleep they get, they manifest emotional distress which increases in severity as dream-loss continues. What this reminds one of is the psychic disorders manifested by prisoners in solitary confinement, by human "guinea pigs" experimentally sealed off from sensory stimuli, and most dramatically of all, by feral children.

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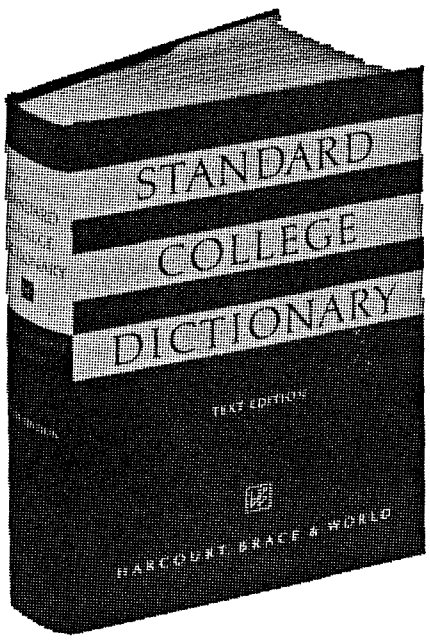

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The common denominator for all these cases is apparently coenetic deprivation, and the "moral" would seem to be that we all require frequent communication—with ourselves as well as with others—to be at once healthy and human.

A fascinating possibility suggested by Dement's experiments is that of eventually constructing some sort of "window on the unconscious" analogous to the plastic windows through which physiologists are already quite literally observing the digestive processes of white rats. If the perodic nocturnal fantasies of sleepers, human and subhuman, could be cast onto some sort of "dream screen" and watched by investigators much as we now watch cinema, there is almost no limit to the amount we could learn in a very short time about still hidden mental processes. Needless to say, few more exciting prospects can be imagined for psychologists and coeneticists—or, for that matter, for the public at large.

One of the most concentrated, explicit, and characteristically human forms of communication is, as we noted above, teaching. Considering how many placental mammals instruct their young, it may not be too much to say that man is an instinctive teacher. But, whatever the source of human preceptivity, it seems unlikely that it can flourish without general recognition of the necessity to encourage intellectual curiosity, not just formulaically but actively, by making it one of the most sacred human obligations to foster and satisfy the questioning urge whenever it manifests itself. For unspoken thoughts and unanswered queries only clog the channels of communication and, in consequence, stunt the growth of the mind. This is as true in the halls of the United Nations as in the homes of private families: "white lies" and evasive language only feed fear and suspicion, which can hardly lead to mutual understanding and may even lead to mutual destruction.

Yet our Age of Anxiety is one of paradoxically high hopes. For if we do not annihilate ourselves and all other earthly species along with us, we earthlings may yet transcend the planetary limits of our current communicative ability and hold high converse with intelligent beings on other worlds—if not in our own stellar system, then in neighboring systems. To this end, the American scientists engaged in Project Ozma have recently begun beaming numerary signals to the nearer stars. In terms of our initial definition, then, we are already in at least minimal communication with these bodies. Let us hope that this communication may one day be blessed with maximality!

Returning, however, from the empyrean to some of the humbler levels of communication, there are other coenetic recommendations that the student of human behavior might make. The first of these has to do with the use of the human senses: When our shrewlike ancestors forsook the ground for the trees, they became—as befitted their semiaerial existence—almost avian in their audio-visual acuity. But for this gain they paid, dearly perhaps, with a corresponding loss in the sensitivity of their chemical receptor organs. Like monkeys, human beings taste little and smell less. As if this were not enough, most human societies have added cultural insult to anatomical injury by systematically downgrading the world of scent and savor along with its denizens. Thus, we call men dogs and pigs to denigrate them. And when we say something "smells," if no qualification is offered, it is invariably taken to be bad.

Moreover, we scorn the tactile almost as much as the chemical: to be "skinny" or "touchy" is nearly as bad as to be "smelly." And our metalinguistic attitudes are consonant. Painters, poets and musicians are artists in most cultures; while cooks, gardeners and hairdressers are seldom more than servants. Similarly, the sciences of optics and sonics are far better developed than that of osmology—the science of smell. (As if to prove my point, there seem to be no common terms for the sciences of touch and taste.)

To rescue these underprivileged and underdeveloped senses from complete inoperativeness, I would recommend a number of attitudinal reforms, to be embodied in such procedures as: systematic cultivation of the

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"lower" senses, an example being the ingenious flavor organ, involving taste-harmonies, described by the French aesthete Karl Huysmans; pediatric and pedagogic encouragement of the emotional reassurance of simple interpersonal body contacts; a determined search by psychiatrists and psychoanalysts for repressed chemical and tactile memories; and the development of a richer vocabulary for discriminating these sensations. (Our English olfactory lexicon, for example, lacks even the rudimentary equivalents of "salty" and "bitter," of "red" and "green" and still subtler distinctions.) Only in such ways can we hope to obey the Taoist injunction that we "learn to find taste in the tasteless" and so make our sensory deserts bloom.

Can Coenetics Survive?

For Coenetics as a discipline, many problems remain. Some of them are rawly empirical, such as that of determining by further and better controlled experiments whether or not, as many parapsychologists now believe, direct thought transfer (or mental telepathy) can occur in the absence of sensory mediation. Others are procedural and entail development of an adequately standardized terminology and taxonomy of communication.

A final problem, potentially perhaps the simplest to solve, has in practice proved the most unyielding single obstacle to the progress of Coenetics. This is the shortage of funds, facilities, research time and, above all, coworkers that has so far kept pioneers like Birdwhistell and Trager from rapidly expanding their operations. Few fields in the area of communication research are as untouched, as challenging and—ultimately, I have no doubt—as rewarding as these early explorations of the minutiae of human interaction. For they are the indispensable data without which all the theoretical sophistication in the world will never permit us to write what the practitioners of so many disciplines have so long dreamed of: a general grammar of behavior.

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The Great Transformation

H. F. WILLIAM PERK

For many years now the military have made use of a technique called "gaming" to assist them in their forward planning. To initiate some advanced planning on the part of those engaged in the field of communications, I intend to borrow from the military and invite you to join me in a little "gaming" of our own.

The technique works like this: you create a "scenario"—just as if you were writing a play—which describes a hypothetical situation in some detail; then you have the "players" or "actors" adopt their various roles and attempt to behave as they would in the situation depicted. Even though this "let's pretend" may strike you as something more likely to be practiced in the nursery school than the inner reaches of the Pentagon, the power and prestige currently enjoyed by the armed forces in our society suggest such techniques are not to be dismissed too lightly.

In any event, our scenario will go like this.

It is twenty years from now—the exact date being October 22, 1985; you are all participating in "Vision 85," an international conference whose theme is "A retrospective look at the Great Transformation of 1965-75." Naturally the conference is being conducted worldwide via communication satellite, so that the audience is on the order of a million times larger than ours today. And since the communication system is two-way, should I wish to ask a question of the audience I would be able to obtain instantly not only the absolute number of those responding, but also to learn in what proportion they held the various answers permitted by the nature of the question posed. By this date, of course, "town meetings of the world" have long been a common occurrence, since the highly developed computerized communication facilities readily permit transmitting information to and from numbers of people who could never conceivably be physically present in the same place at the same time.

But so much for the prologue. Ready? Here we go . . .

Ladies and gentlemen, welcome to the second half of our Vision 85 International Conference. I would like to begin my presentation by reviewing some of the critical events of the 1965-75 decade. I will then attempt to show that the common interpretation of these events—that they constituted necessary and sufficient conditions for the Great Transformation—is mistaken; that there is considerable evidence to support my theory that these events are merely historical accidents—"noise" in the system as it changed state; and that the truly necessary and sufficient conditions for the Great Transformation are to be found elsewhere. I am well aware that distinguished scholars hold views to the contrary; all I ask is that you maintain an open mind until I have finished developing my thesis, and then judge for yourself where the truth lies.

Since the critical events to which I refer must be well known to all members of this audience, I shall recount them in a summary fashion.

The Second World War ended in the middle forties, and after a brief hiatus during which former bitter enemies became staunch allies and vice versa, there began the twenty-year period known as the cold

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✪ H. F. WILLIAM PERK writes that he "attributes his deep concern for the impact of science and technology on society to the ten years he spent as a research scientist with such organizations as the RAND Corporation, Lockheed Electronics Company and I.T.T." Mr. Perk is on the faculty of the design department at Southern Illinois University, and an officer and cofounder of the Institute for Cybercultural Research. This is a Vision 65 paper.

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war. During this period the various "great powers," so-called, prepared for war as they had never done before. The atom bomb—itself a thousandfold more powerful than anything else used in World War II—was soon surpassed by the H-bomb, a thousandfold more powerful than the atom bomb. In less than a decade after the end of hostilities, then, man's destructive power had increased a million times. It could well have kept on for several orders of magnitude more, except that there were no targets on the planet large enough to warrant such development; man had entered the age of "overkill."

The development of missile delivery systems for these weapons had pushed the transport of mass from one part of the planet to another to its effective limit: if it were to go any faster, a missile would enter an earth orbit or escape the planet altogether. Thus, in a short twenty years man's entire history of developing systems of destruction reached its natural limit: man would never be able to do more than kill everything immediately.

The cold war was marked by ceaseless conflict all over the world, but conflict of a kind and at a level that had avoided precipitating nuclear war. Indeed, by the early sixties there were signs that the cold war might somehow conclude without any more nuclear weapons being fired in anger.

There is essential agreement among most scholars that the Great Transformation occurred between 1965 and 1975; and that it is most appropriately viewed as consisting of three fairly distinct phases. Phase One has been designated the "Time of Terror," and it spans the first three years of the period (1965, '66 and '67). It was during this phase that the final dissolution of the major power blocs occurred, along with proliferation of nuclear weapons (the *n* in the "*N*th-country problem" had reached thirteen by 1968). Brush-fire wars broke out with increasing frequency all over the planet—each one of which threatened to upset what had been called "the delicate balance of terror": by 1968 there was distinct terror and very little balance.

Phase Two, frequently referred to as "the Conversion," is compressed into the two years 1968-69. For reasons that are still a subject of dispute among historians, the established order in almost every region of the world was replaced—by one means or another—with a new leadership dedicated to the proposition that peace and abundance shall become the common condition of all mankind. To this end various agreements were entered into, usually under United Nations' auspices, the net effect of which was to initiate a "World War on Want." This is the designation given to Phase Three, which lasted from 1970 to 1975, and saw the most extraordinary burst of creative production and distribution of the goods and services of civilization imaginable. It was World War II a hundred times over—only without the destructive effects. Recall that in the Second World War an enormous quantity of physical things was produced, packaged, shipped to various parts of the planet, and finally delivered to the "consumer" all without charge—but, unhappily, with destructive effect. During the World War on Want it was much the same process all over again—but with a wholly constructive set of consequences. It was during this phase, of course, that monetary systems—with all their frictions and frustrations—gave way before the realization that the regenerative cybernated productive systems that had been organized to accomplish the objectives of the World War on Want made the archaic concepts of buying and selling, payment, debt, credit and all the rest, irrelevant. When abundance had been achieved on a worldwide basis, all the obsolete paraphernalia of economic systems based on scarcity could be dispensed with, and were.

The decade since 1975, following the Great Transformation, has been one of consolidation and control. Some five percent of the planet's population is still required to oversee the worldwide cybernated productive system, but this figure is likely to drop as the condition of dynamic ultrastability is reached. Upon first achieving abundance, of course, the tendency of the population was to overestimate their needs; but, as the years of deprivation re-

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ceded, demand began to drop off. There is every indication that the system will continue to oscillate over a fairly wide range for some years to come before settling down within the predicted limits of variation. But there is no denying that from here on we are in the cybercultural era.

So much for our brief review of the Great Transformation, its background and subsequent developments; now let me get to the bone of contention.

Orthodox theory might be summed up as follows: the Great Transformation was the precondition for worldwide abundance and entry into the cybercultural era. My theory, on the other hand, is almost precisely the reverse: namely, that the potential for worldwide abundance, and entry into the cybercultural era, was the precondition for the Great Transformation!

Proof for the validity of my theory may be adduced under the following major categories: (1) the evidence of World War II; (2) the evidence of the cold war; (3) technological evidence; (4) the evidence of organization and planning; and (5) the evidence of power and politics. Let's examine the evidence in each of these categories.

There is reason to believe that the Great Depression that preceded World War II was as bad as it was because the technical possibility of abundance was already immanent, and the controllers of the industrial system did not know how to cope with this condition. In any case, the immense production achieved during the War—not only of the material and equipment needed to produce and deliver armaments, but also of civilian consumer goods—constituted an irrefutable demonstration that the industrial system could, indeed, create abundance. Consider what had been accomplished during the half decade of overt hostilities: the United States produced forty-five percent of all the armament that *was* produced—by all the belligerents combined; this material was delivered to various parts of the planet and dumped on the enemy "for free"—that is, with no compensating monetary or material consideration; a thorough modernization and expansion of the industrial plant was achieved; in addition to the war production itself, production of consumer goods increased during each year of the War; and, of course, with all those men under arms the problem of "unemployment" was solved—at least temporarily.

But this leads us directly to consider the evidence of the cold war.

At this point I wish to quote directly from an author who wrote prior to the Great Transformation, and who provided significant evidence supporting my theory. The author is one David Bazelon, and his work—which first appeared in 1963—is entitled *The Paper Economy*. The quotation can be found on page 378:

> . . . We may say that war is the most important illegal institution in our society. Now by "illegal" I don't mean it should be put in jail: I mean it contradicts our premises and professions, and we don't like to admit it exists or that we need it. But in fact we couldn't possibly get along without it. It is so essential that, not having a real war to fight, we have invented a make-believe one so that we do not have to attempt the impossible and forego the benefit of it. Why? Because war is artificial demand, within the terms of the Paper Economy, and the only such that does not raise any political issues. The essential aspect of this artificial demand is that the *product* does nobody any good—only the *process* is beneficial: *war, and only war, solves the problem of inventory.* In the past, it was expected that resources devoted to war would be recouped by plunder in the event of victory. It was a speculative business venture, financed by daring entrepreneurs, with the price of the goods to be collected after effective delivery. Modern war is no such rational thing. The goods are given away. Payment for them would ruin the recipient: *vide,* German reparations after World War I. Further, one of the substantial but less noticed advantages of war is the opportunity after "victory" to give away more goods in order to rehabilitate the customer.

I won't bore you with citing details of the incredible size of the military establishment during the cold war period; suffice it to say that about one of every ten jobs in the economy of the time were directly or indirectly related to what they euphemistically called the "defense industry."

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But leaving the military aside for the moment, consider some other signs that abundance had in fact been achieved, even if not admitted. First, there was the practice of "planned obsolescence" of consumer products, which accounted for a prodigious amount of waste (you can find a book of that period wholly devoted to the subject; it's appropriately entitled *The Waste Makers*). Then there was the national institution referred to as "Madison Avenue," whose principal and primary functions were to create demand for products that nobody knew they wanted and to switch demand from one "brand" to another—obviously superfluous activities if true scarcity prevailed. And, of course, there is the evidence of unused industrial capacity, idle men and machines that—had they been fully utilized—could have added at least ten to twenty percent to the output of goods and services. The case of agricultural surpluses is so well known and documented that I need but mention it in passing.

So far the evidence I have cited has been almost exclusively concerned with the question of abundance, especially as seen from the point of view of North American experience. While the United States at the time was the most advanced industrial nation, Europe, the Soviet Union and Japan were not too far behind. Our Institute has simulated these industrial systems as they then existed, and explored the question of what would have happened had they combined so as to produce abundance for the entire population of the planet. Extensive replications of these simulations, using Markoff-Monte Carlo perturbation analysis, prove beyond all reasonable doubt that this capability did indeed exist. In fact, incredible as it first seemed, variations of these studies—considering the United States by itself—showed with high confidence that the United States *alone* had the necessary capability to produce such abundance; although it would have taken about forty percent longer, and required greater reliance on synthetic foods.

Our next category, technological evidence, while not leaving abundance out of account, will introduce the matter of evidence for entry into the cybercultural era.

Let's go back to fundamentals for a moment. Recall that in preliterate cultures communication is largely a homeostatic process. For example, the tribal chieftain in council with his principal advisers around the campfire communicates in a manner that may be described as: closed-loop, real-time, on-line, multisensory mode. Messages are exchanged in such a way as to reinforce the principal values of the culture, feedback is immediate as are error-corrections, and all the human sensory equipment may be brought into play. Because the facilities for recording the messages consist solely of the human memory, however, this puts severe limits on the ability to accumulate diverse experiences and transmit them through time and space. Thus, innovation is necessarily limited. The culture is in control, but at a relatively low level of complexity.

The advent of writing—and especially printing technology—changes all this. Written messages may reach their audience at any time or place, even after the death of the writer; the message may be duplicated and read by persons not contemplated by the writer; the messages may or may not reinforce cultural values, but in any case the reader has little or no opportunity for feedback to the author. This communication process may thus be described as: nonhomeostatic, open-loop, non-real-time, off-line, single-sensory mode. Print technology is fairly effective at storing diverse experiences and making this cumulative record available through time and space to all who are themselves literate; it thus facilitates innovation. The culture is out of control, and owing to the positive feedback nature of the literate process, tends to reach higher levels of cultural complexity.

Now observe the situation during the period with which we are principally concerned: electronic technology had reached the point—at least in the military and space programs—where almost any combination of characteristics could be employed. Take the "space spectaculars" of the early sixties, for example. Here one

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could witness the launching of an astronaut via "live"—that is, real-time—television; the audience for such a performance might well number in the tens of millions or even hundreds of millions. While the audience was limited to audio-visual sensory modes, and no feedback was possible, the communication between the astronaut and his base would normally encompass multisensory modes. Thus, the astronaut's physiological data—heart rate, temperature, blood pressure and so forth —would be telemetered straight to the computer for on-line, real-time analysis, along with any verbal messages he might wish to exchange, plus numerous other forms of data sensed by devices whose capabilities lay well outside the range of human sensory equipment. And all of this could be recorded for immediate playback or for playback on any later occasion.

But let's consider another aspect of the capabilities of that time. While preliterate and literate peoples are constrained to transfer and duplicate individual skills by the laborious "show-me" method—the literate peoples may be the more self-conscious about it, and even attempt to go beyond their obvious limitations via the "programmed learning" methodology of the late literate period—the postliterate period opened entirely new dimensions. For example, training for military tasks frequently involved elaborate simulation facilities and exercises, as did the training for space missions. Far more significant than these efforts, however, was the use of computers to replicate a desired skill. Thus, once a bright mathematician, say, had devised a method for solving some class of problems, the computer program could be duplicated for the benefit of anyone else at any other place having suitable equipment. Or the program for producing some desired physical item on a numerically controlled machine tool could be made to activate such machines at as many remote locations as desired.

These and many more examples that could be cited all lead to only one possible conclusion: the technological preconditions for entry into the cybercultural era did indeed exist *before* the Great Transformation. We might summarize the situation by means of the following diagram.

	Power	Skill	Control	Intelligence	Policy
1	Man	Man	Man	Man	Man
2	Animal	Man	Man	Man	Man
3	Machine	Man	Man	Man	Man
4	Machine	Machine	Man	Man	Man
5	Machine	Machine	Machine	Man	Man
6	Machine	Machine	Machine	Machine	Man

In the prehistoric period, Level One, man depended entirely upon himself for the accomplishment of his tasks. From the neolithic revolution, all through the agricultural era, up to the industrial revolution, only animal power was utilized to augment man's own capabilities, as is shown by Level Two. The first industrial revolution, Level Three, saw the substitution of machine power for animal power. The second industrial revolution, Level Four, saw the machine enter a new dimension, the augmenting of man's skill by machine skill. This brings us to Level Five, and to the period just prior to the Great Transformation; here we see the machine being introduced for purposes of *control;* and there is evidence that the theory of intelligent machines was being intensively worked on, mainly—as usual—under the sponsorship of the military. We are on Level Six now, of course; intelligent machines are commonplace throughout the industrial network. Unless, however, we wish to exemplify Nietzsche's remark to the effect that "Man is but the bridge over the abyss to Superman," I would resist extending this diagram to a seventh level.

As we all know, entry into the cybercultural era is an irreversible process that has worldwide abundance as its inevitable consequence. Thus, my demonstration that at least the United States—and probably one or more of the other most advanced industrial systems—had in fact entered this era *prior* to the Great Transformation should be sufficient to prove the validity of my theory. Nevertheless, I shall cite some ad-

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ditional evidence from the two remaining categories mentioned earlier.

It is a truism that technology creates organization; thus, we would expect to find extensive organization during the period prior to the Great Transformation. And, indeed, that is precisely what we do find: but with a peculiar ambiguity involved. That is, the concentration of power in organizations had never before—nor has it since—reached the degree it did during the fifties and sixties. On the one hand this was tacitly recognized by the number and variety of scholarly publications devoted to the subject of "bureaucracy," "management," "principles of organization," and similar related subjects. Surprisingly, however, public discourse on the matter is conspicuous by its absence. Public debate over the issues of the day was conducted in some obscure code which employed eighteenth- and nineteenth-century terms—"individualism," "free enterprise," "private property" and the like—when referring to enormous corporate entities engaged in extensive coordinated activities of the most public nature. And these organizations—in actual fact, of course, private governments—were quite autocratic in structure, and apparently responsible to no other source of power than themselves. That is, they were evidently illegitimate institutions in the society of which they were a part, in the same sense that we saw earlier was the case with war.

Bazelon, as a matter of fact, has some cogent words for us on this matter as well:

> In a democratic society, defined for modern purposes, *all* power centers would be subject to political questioning, review and action, under certain minimal rules of procedure. Yet we now have two governments in the United States, only one of which is subject to political action on the part of the electorate . . . [He goes on to say that these private governments are necessary, and might not be too bad if it weren't for the effect they have on the development of democratic culture; then he continues as follows] . . . The second government governs mostly by denying its own existence, which requires immense ideological distortion, and by additional domination and perversion of the entire national culture, which it finances.

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It attacks directly and covertly undermines its weak sister, the official government, on a continuing basis. It lives not by the sword, but by perfidy. If the traditional state exists by virtue of a domestic monopoly of armed force, then our second form of government exists by exercising a national monopoly of effective fabrication. [This may be found on pages 361-2.]

Now that we have dispensed with armed force, and machines are the most conspicuous "electorate" of our own industrial "bureaucracies," the situation prior to the Great Transformation looks grim indeed!

Organizations cannot exist without planning, so that it is obvious a great deal of planning was done during the period in question. But here again we find the same peculiar ambivalence: at least in the United States, planning was publicly frowned upon by the very corporations that could not have existed without it. No doubt this is another aspect of the ideological distortion referred to by Bazelon. In any case, the evidence for large-scale, long-range planning activity by various agencies of the official and unofficial governments is overwhelming. How they could deny the virtue in planning while diligently planning to put a man on the moon is beyond me. The confusion in those times must have been well-nigh unbearable.

Again, I think I have proved my point: the organizational capacity and planning talent necessary for achieving abundance and for entry into the cybercultural era existed *prior* to the Great Transformation. This brings us to our final category.

One of the students of organization of those times had written that never in the history of man had power been so concentrated as it was in the United States, circa 1960. This can be illustrated by considering for a moment how many positions of critical decision-making authority existed at that time.

The matter of the survival of the society surely constitutes the supremely critical area for decision making, so let us look at this first. You may recall from your history lessons the so-called "Cuban Missile Crisis" of October 1962; if so, you will probably remember that the significant decision making during that crisis was effectively limited to the heads of state of the two major nuclear powers involved plus a dozen or so advisers in each instance. Had this situation reached the point at which a final decision to commit genocide and suicide was made, this decision on behalf of the world's population would have been made by fewer than a hundred men, perhaps as few as two. Can power be any more concentrated than this?

The situation in regard to the system of private governments was only slightly less striking. A generous estimate of seats of critical decision making in that system would be on the order of ten thousand—give or take an order of magnitude. The trend, of course—because of the continuing integration of the industrial system, quaintly called "merger" in those days—was toward fewer rather than more such positions.

The significant political activity that took place back then naturally took place within the private governments—that's where most of what was to be had was to be found. Since these private governments were in the nature of "voluntary totalitarianisms"—highly autocratic in structure, they had no rules or procedures for allowing "government by the consent of the governed"—there was inherently a conflict between the managerial echelon and the rest of the people engaged in the organization's activities. This, of course, encouraged the managers to find ways and means of eliminating the need for reliance on such a refractory underlying population. As for the managers themselves—well, each rank sought ways to advance to the rank above, or prevent advance from the rank below, all in the hope of avoiding the fate of the underlying population. Incidentally, it is amusing to read some of the charges made by managers of corporations in the United States against their counterparts in the Soviet Union. You would never believe from these diatribes that the politics of the Kremlin were almost indistinguishable from those to be found in the Executive Suite of a major U. S. corporation.

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Could we conceive of any situation more suited to the introduction of intelligent machines?

We might sum up all the evidence in the following way: (1) technologically and organizationally, the major industrial powers had the capacity by 1965 to achieve abundance on a worldwide scale; (2) in all the major industrial systems, by 1965 power had been sufficiently concentrated to ensure that if the political decision to achieve abundance were to be made, the system could implement such a decision; but, (3) the industrial system was so governed as to thwart the making of such a political decision; and (4) because of the entry into the cybercultural era, with its concomitant substitution of machines for men throughout the industrial process, the disenfranchised industrial "electorate" had every incentive for ensuring that the political decision to achieve abundance would indeed be made.

Obviously, something had to give! Are these not precisely the necessary and sufficient conditions for the Great Transformation?

Well, there you have it: a brief overview at least of some of the extensive evidence I have uncovered to prove my theory that the potential for worldwide abundance, and entry into the cybercultural era was in fact a precondition for the Great Transformation. Actually, it is hard for me to understand the scholarly insistence on the contrary view, since there are perfectly sound grounds for believing that the cybercultural era is an equifinal state—to use the general systems theory terminology—and that the world would have reached it from any number of different initial states. Just for fun, one day at the Institute we tested this notion by trying to have our colleagues devise all the possible paths leading to the equifinal state from various specified earlier time periods. It was soon demonstrated, of course, that the number of such paths exceeded even the capacity of the combined World Infonet to compute.

To paraphrase an ancient saying, "All roads lead to the cybercultural era."

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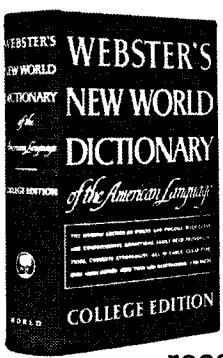

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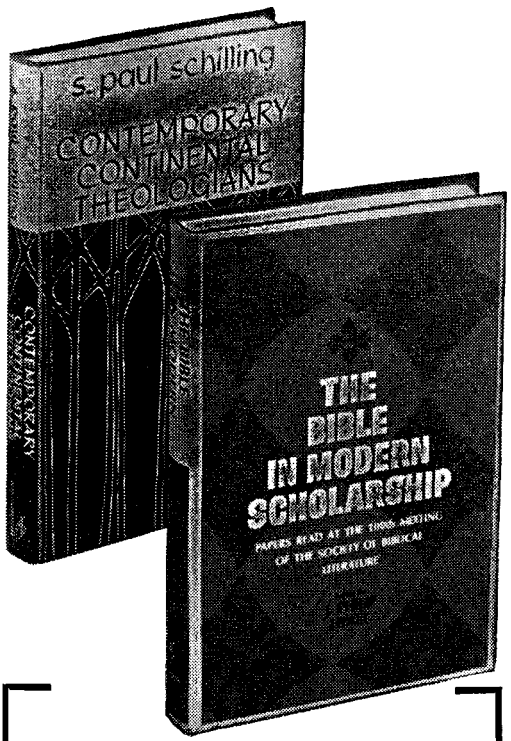

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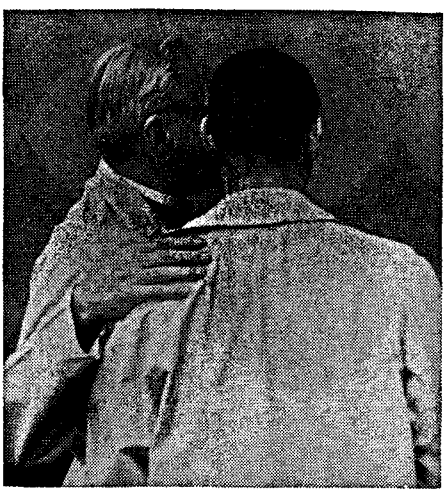

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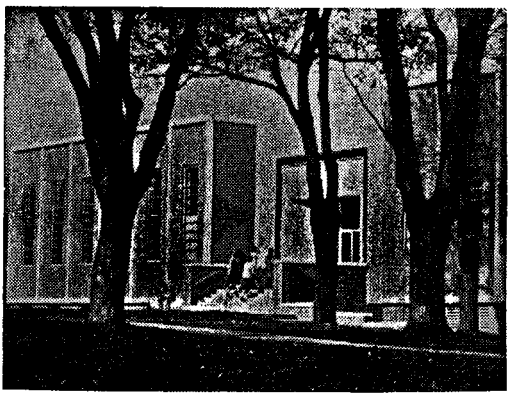

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The Reader Replies

THE READER REPLIES *carries miscellaneous comments by readers and authors on various articles that have appeared in the magazine. All communications should be addressed to: Editor,* THE AMERICAN SCHOLAR, *1811 Q Street, N.W., Washington, D. C. 20009. Because of space limitations we cannot guarantee to print all letters received.*

—EDITOR

I was very pleased by G. D. Lillibridge's article, "The American Impact Abroad: Past and Present," in the Winter issue of the SCHOLAR because it very effectively described the dilemma we face today as a result of a misunderstanding of the reasons for our once profound influence on the world community. More importantly, this article is significant because of its conciseness; Lillibridge has succeeded in explaining the American dilemma in a manageable article where many learned writers have, either partially or wholly, failed to make the same point in comprehensive monographs.

While this article explains the crux of our dilemma vis-a-vis the world community it leaves two very crucial questions unanswered. How do we make the American people fully aware of the nature of the dilemma? And, assuming we can make Americans cognizant of and responsive to the dilemma, what are the problems involved in creating a foreign policy that will require fewer demands and commitments of other nations and will, at the same time, effectively thwart Communist expansion?

TIMOTHY J. LOONEY
George Washington University

* * *

I am enormously impressed by the brilliance and the timeliness of Storm Jameson's "The Writer in Contemporary Society" [AS: Winter, 1965-66].

My most enthusiastic congratulations to you upon having the honor to publish it. I should like every one of my students to have a copy of it.

THEOPHILUS E. M. BOLL
University of Pennsylvania

* * *

Huzzah and hats off to Storm Jameson for "The Writer in Contemporary Society" in your Winter issue. She has lucidly expressed the turgid thinking of many troubled folk like myself. Please thank her for her meaningful article.

FLORENCE BOOCHEVER
Albany, New York

* * *

If one wanted to teach a beginning bird watcher how to recognize an Eastern Phoebe, he could hardly do better than to list the features Walter Teller ascribes to his "Pewee" in THE WAY IT IS: "Against a Background of Summer," Winter, 1965-66. Unless Mr. Teller becomes more familiar with the contents of his bird books, his series will have to be re-titled THE WAY IT IS NOT.

GEORGE PITCHER
Princeton, New Jersey

* * *

It is surprising to find the usually reliable pages of the SCHOLAR marred by an ornithological misidentification that not even a beginner in bird study should make. I refer to Walter Teller's "pewee" (in his column in the Winter issue), which is no pewee. But Mr. Teller has the makings of a good bird watcher, for he gives the requisite details for correct identification: "time was when pewees built their nests on the timbers of bridges"; "occasionally wagging his tail"; "not a songster, speaks in a modest twit"; "his bill is black."

The bird described could only be a phoebe, a cousin, although not a very close one, of the pewee. Or do they call phoebes pewees on Mr. Teller's island?

EDWARD T. CONE
Princeton, New Jersey

MR. TELLER replies: The bird I called pewee was indeed a phoebe and as Mr. Pitcher says, an Eastern Phoebe. Mr. Pitcher scores.

Pewee, as Mr. Cone surmises, seems to be an alternative name for phoebe. Mr. Cone scores.

Webster's New International, Second Edition, gives as a meaning of pewee, phoebe. *A Dictionary of Americanisms* defines pewee, also pewit, as "the phoebe bird."

Bagg and Eliot, *Birds of the Connecticut Valley in Massachusetts,* say the bird in question was named by Wilson pewee, or pewit. Wilson also named the Wood Pewee. Later ornithologists, the better to distinguish them, referred to the original pewee as Bridge Pewee, House Pewee, sometimes Pewee Flycatcher. Phoebe, a daughter of Gaea, the moon personified, a feminine proper name, doesn't make sense. Doesn't the bird look more pewee than phoebe? But you can't fight the field guides, you can't fight usage any more than you can fight city hall. Phoebe called pewee did not go

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unchallenged and I am glad it did not. I would have been sorry to miss these warm, witty, generous and scholarly letters.

I was very impressed by Professor Hardin Craig's notes on scholarly method, "How to Be a Productive Scholar Without Any Time to Work," in the Winter issue of THE AMERICAN SCHOLAR. I would like to make it available to our faculty and students. Could I therefore have your permission to reproduce it and hand it out to them in the hopes that some of them may be inspired by it?

THE REVEREND HENRY ST. C. LAVIN, S.J.
Dean of Studies
Loyola College
Baltimore, Maryland

* * *

Hiram Haydn's stirring reach for a "workable humanist morality" [AS: Winter, 1965-66] in our "tohu bohu" extends, paradoxically, from a theistic ladder. If the brilliant skeptic and critic of his sixteenth-century church, Montaigne, provides the first rung, Bergson and Buber constitute the second and third leading upward. They emphatically declined Nietzsche's bombastic invitation to attend God's funeral. Nor, if I read them aright, did they rush to participate in the conceptual ceremonies celebrating the Coronation of Man as Emperor of the Universe trumpeted by Julian Huxley.

In his *Creative Evolution* and particularly in his later *The Two Sources of Morality and Religion,* Bergson probes for the immanence of God. He says in the chapter on Dynamic Religion, "It [the human species] would never for an instant have thought of becoming completely itself, if certain representatives of it had not succeeded in breaking through the resistance put up by the instrument, in triumphing over materiality—in a word getting back to God. These men are the mystics. They have blazed a trail along which other men may pass. They have, by this very act, *shown the philosopher the whence and whither of life.*

As for Buber, tear God out of his thought and you demote a profound religious philosopher to a mere translator and anthologist of the quaint. What sense does "I and Thou" make sans God? "The external lines of relations," he concludes in that seminal thrust of the spirit, "meet in the eternal Thou. Every particular Thou is a glimpse to the eternal Thou. . . ."

The quest for a meaningful communicable morality must be pursued in the roots of the whole of being. The insistence of the articulate intelligentsia to divorce God from man abets ruinous fragmentation. A sense of the Abso-

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lute and an awareness of the indivisibility of the universe seem to me indispensables for a "working morality." Else group discussions on morals and ethics [AS: Summer, 1965], and personal probing, however deep, must reduce the Thou into It and further inflate Haydn's "man-chine" or Wiener's "golem."

"Mankind lies groaning, half crushed beneath the weight of its own progress," said Bergson in 1932. How exponentially that weight has increased these last thirty-odd years, and how much more excruciating the groan.

No. Man striving alone cannot lift the burden, he can only add to it. To give man hope a "workable humanist morality," as Haydn's radiant "apologia" unwittingly implies, demands a pinch of the "mysterium."

DR. ELY E. PILCHIK, RABBI
South Orange, New Jersey

* * *

On Reading Your Winter Issue

Why is it
that the SCHOLAR
prints
poems by wise sixteen-year olds
(p. 78)
and yet refuses
mine?

BAH!

I will retreat
to frigid
peaks,
repine
over
loves long gone,
and dream (mad bard)
of my own
lost
youth

when I too
had a voice
and
sang
of faroff days
when my own
heart
wore
"cherry coloured hose"
and
I too was
sixteen.

JOHN RUYLE
Berkeley, California

* * *

I am sure Joseph Wood Krutch must have more "wise sayings to counteract the blandishments of specific persuaders" in his Pieces-of-string-too-short-to-save File than he shared with us in his column, IF YOU DON'T MIND MY SAYING SO, in the Autumn issue. Nevertheless, in case these are not among his collection, I thought I should suggest them to counteract the blandishments of cigarette advertisers.

I call your attention to the old Russian proverb: "Vodka is cursed, tea is twice cursed, coffee and tobacco are thrice cursed."

James I of England: "Herein is not only a great vanity but a great contempt of God's good gifts, that the sweetness of man's breath, being a good gift of God, should be willfully corrupted by this stinking smoke."

Or, to move from the seventeenth to the eighteenth century, Samuel Johnson is still saying the same thing. "Smoking is a shocking thing—blowing smoke out of our mouths into other people's mouths, eyes and noses, and having the same thing done to us."

To move from Russia and England to the United States and to the nineteenth century, Elbert Hubbard said, "Never advance the pay of a cigarette smoker, never promote him, never depend upon him to carry a letter to Garcia unless you are willing to lose the letter."

DURRETT WAGNER
Dean of the College
Kendall College

* * *

THE AMERICAN SCHOLAR deserves special commendation for publishing "Atlantic Wall," by Rosalie Colie [Autumn, 1965]. Miss Colie has developed her theme in a complex and leisurely manner. To intensify her meaning she draws on all the technical resources of the main tradition of English poetry. Her references to objective historical facts reinforce her subjective insights by providing points of contact between the poet's personal observations and the reader's awareness of universal human experience.

Miss Colie's viewpoint is also worthy of note, for it is at once scholarly and womanly. The prevailing tone of female scholarship has been either ruthlessly asexual or outspokenly feminist. Both in this poem and in her study of Marjorie Nicolson [AS: Summer, 1965], Miss Colie shows how a woman with feminine interests and attitudes may use scholarly methods to throw new light on questions previously discussed only in contexts established by men. By so doing she sets a much-needed example for the increasing community of women scholars.

Imaginative scholarship on the order of Miss Colie's helps to fill an important gap. It is both a pleasure and an inspiration to see her work, and a pleasure also to see THE AMERICAN

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SCHOLAR providing a showcase for such an original contribution to American literature.

ALICE P. KENNEY
Cedar Crest College

* * *

I must complain that the appearance of Ihab Hassan's article, "The Novel of Outrage: A Minority Voice in Postwar American Fiction," in the Spring of 1965 issue is itself an outrage, on several counts. As the blurb on the author acknowledges, "This is Ihab Hassan's third essay on modern literature for the SCHOLAR." Doesn't it seem that the acceptance and publication of three articles on the same general subject by the same author in a relatively short period of time is a little "much" in a journal whose standards are supposed to be as discriminating and whose tastes are supposed to be as varied as the SCHOLAR's? When one notices that Mr. Hassan's academic affiliation is with Wesleyan University and that three out of four of the reviews dealing with books on literature in the same issue are also by professors from Wesleyan University, he raises his eyebrows even higher. This smacks of favoritism or boondoggling in the very journal that I, as a member of Phi Beta Kappa, had always assumed was dedicated to the kinds of standards which that organization represents and to the principles of scholarly excellence associated with the memory of Ralph Waldo Emerson's pronouncement.

There might be some defense for the repeated appearance of this author's work in the SCHOLAR if it were patently the best available. But that is also not the case. Hassan's materials are artificially intellectualized and his language overly elaborate and belabored. Reading one of his articles was tiring enough, but three simply put one out of countenance. In fact, as a reader and annotator for another journal's bibliography committee, I have been disappointed to find a number of the SCHOLAR's articles that I have been assigned to read far below the standards that I had expected in a publication of such renown. I wonder if the editors of the "quarterly for the independent thinker" ought not take inventory of their standards and methods of selection of articles and reviews for publication.

JAMES L. ALLEN, JR.
University of Hawaii

* * *

The SCHOLAR Symposium on Morality [Summer, 1965] was laudable but foredoomed to failure. The supposedly detached analysis of morality always comes out heavily charged with moral, immoral, or "morally invented" impulses, as Professor Polanyi of Oxford has pointed out in "Scientific Outlook: Its Sickness and Cure," *Science*, March 15, 1957.

Detachment destroys our knowledge of many things: The meaning of a word vanishes if I cease to mean anything by it; the proof of a mathematical theorem dissolves if I cease to trust it; and, likewise, a moral ideal dissolves if I stop respecting it. This last happened to the Nihilists a century ago, when moral inversion set in in Russia. The contempt for all accepted morality turned into a hatred of all existing society and thence into a total dedication of themselves to the task of a merciless social revolution.

Once the frank expressions of our moral passions are discredited by a detached scientific approach, they will seek some outlet that is protected against our scientific self-doubt. Moral inversion is a logically more stable state. This is what happened in the totalitarian revolutions of our time over immense areas of Europe and Asia.

An outlet for moral passions, such as the struggle for civil rights, is today necessary to maintain alive our sense of justice in other areas.

GILBERT E. DOAN
Nazareth, Pennsylvania

* * *

When I saw the title "Night Flight" by Mary Oliver in the Winter issue of your magazine, I was very interested. Just about two weeks ago I was a passenger on a night flight. Could Mary Oliver's poem make me again visualize the flight? I wanted to know if it could.

The poem brought my mind back to the flight. What more concise and accurate way is there to describe the descent than the words, "Buckled for landing to a tilting chair"?

Something, however, unexpectedly impressed me more. I allude to the realism of the underlying spiritual concepts. Very often one, like the passenger, thinks of eternal values or even prays when in danger, but soon forgets his fears. The lights of life, like those of the suburbs, make him leave his reverie.

I would like to read more poems in this moral vein in your magazine. Not only did the poem possess the fine qualities mentioned, but its subtlety interested the thinker. Still the simplicity of "Night Flight" made it intelligible to those not yet scholarly.

ELIZABETH C. SMITH
Greenville College
Greenville, Illinois

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